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October 18, 1934

Engineering News-Record

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Constructing a mixed-in-place bituminous road on a state highway route in Vermont.

UNUSUAL CONTINUOUS-GIRDER GRADE SEPARATION

CAPACITY OF TIMBER CULVERTS STUDIED

NEW TYPE OF FLAT-SLAB BUILDING DESIGN

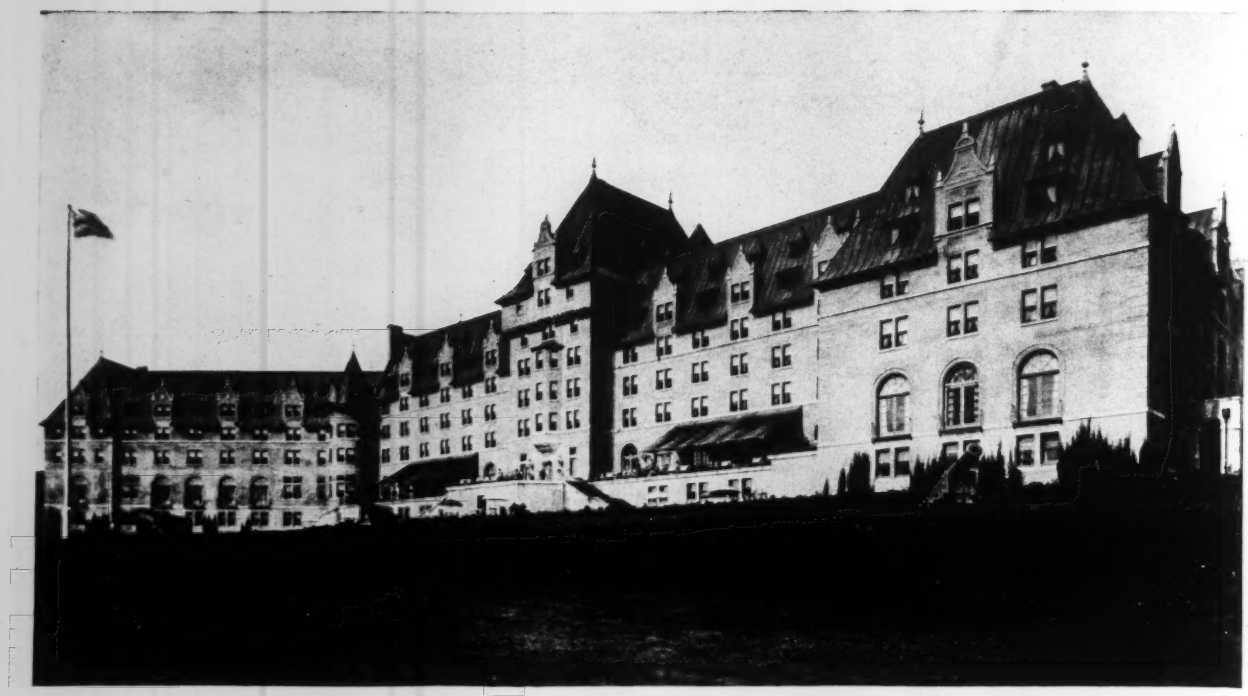
ALL-AMERICAN CANAL PROJECTS STARTED

AGGREGATE CONTROL ON MIXED-IN-PLACE ROADS

JOB PRODUCTION ON SMALL HIGHWAY BRIDGES

Groundwater in the Midwest Drought Area

By O. E. Meinzer, U. S. Geological Survey



Manoir Richelieu Hotel, Murray Bay, Quebec. Walls, floors and structural frame of monolithic concrete. Architect, John S. Archibald, Montreal. Contractor, Wilde & Brydon, Toronto

40° below zero at MURRAY BAY . . . .

but construction of the Manoir Richelieu with Monolithic Concrete never faltered!

The time . . . . mid-September, 1928.

The place . . . . atop a precipitous cliff 200 feet above the wharf and railway siding at Murray Bay, Quebec.

The scene . . . . desolation! The smoking ruins of what was once the famous Manoir Richelieu.

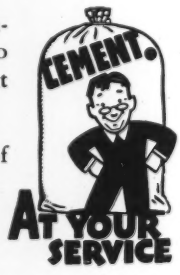
The problem . . to plan and construct a magnificent 300 room hotel in the heart of the wilderness—to do it within eight months and in the dead of winter.

There's drama in that situation—and drama in the story of how the job was done.

The Canada Steamship Company called in architect John S. Archibald of Montreal to study the problem. Inevitably he reached the conclusion—"We'll build with Concrete."

The builders overcame the obstacle of extreme cold by heating the materials and by erecting a wooden outer-shell to protect the fresh concrete. Construction progressed according to schedule and the hotel was ready for the next summer season.

If it could be done during the extreme cold of winter at Murray Bay, it can be done anywhere. Write us for further information on cold weather construction.



PORTLAND CEMENT ASSOCIATION

Room 8103, 33 West Grand Ave., Chicago, Illinois

Responsibility Must Go With Power

DURING the last year we have heard a lot about "collective bargaining." It is the subject of what has become perhaps the most controversial clause of the National Industrial Recovery Act; it has dragged industrialists into the courts to justify their labor policies; it has precipitated bloody strife which has involved no substantial differences over wages, hours or other practical considerations; it has drafted the personal services of the President of the United States to aid in its interpretation; it has become the battle-cry of many labor organizations.

During all this, however, little emphasis has been laid upon one point which, to this writer, seems to lie at the heart of the controversy. That point touches the very essence of all bargaining. Collective bargaining, or any other kind of bargaining, implies delivery as well as collection, giving as well as getting. To be successful, any bargain must involve an equitable exchange of values; each party must feel that he is receiving a value comparable with that which he gives.

Obviously, then, true bargaining must involve on both sides a faith in the ability as well as the willingness of the other to deliver the goods.

It is quite possible that a major difficulty in this matter of collective bargaining is a doubt on the part of employers as to the ability of certain labor leaders to deliver. Few employers express reluctance to pay better wages, observe improved working conditions or otherwise to conform to the labor provisions of the National Industrial Recovery Act. But many of them voice a fear that, with the present set-up of organized labor, their efforts at collective bargaining may result in an unwarranted and destructive interference in their management by unrepresentative and irresponsible labor groups and leaders. They feel that many labor organizations are set up for the sole purpose of "getting," with no sense of responsibility for delivery. They see danger in governmental sanction for such organizations.

Here, it would seem, lies the dominant problem of enlightened labor leadership. The National Industrial Recovery Act attempts to establish a means to foster genuine negotiation and bargaining between employers and employees. At best, however, this is no more than an opportunity. If such bargaining is to be fruitful of industrial peace it must be conducted by parties that are, beyond a doubt, truly representative, responsible in the courts for their acts and agreements and just as effective when it comes to delivering their share of the bargain as they are in exacting the consideration due to them. Moreover, any group, whether of employers or employees, that would enjoy the authority of governmental sanction and that might invoke the power of government to enforce its bargains should be fully accountable to that government with respect to its administrative and financial operations.

When an independent and self-constituted agency presumes to speak or bargain in behalf of any special group it is unofficial and must stand or fall on the case it makes at the bar of public opinion; but when such an agency seeks official sanction as an arm of the government and would invoke the authority of the government to enforce its bargains, it should organize in such fashion as to leave no doubt that it is truly representative of voluntary clients, that it is responsible in the courts for the performance of its bargains and that its administrative and financial operations are wholly legitimate and lawful.

Before the ideal of the National Industrial Recovery Act can be realized and collective bargaining established as a feature of industrial practice, both industry and labor must set up organizations that will meet these tests and conform to these principles. Otherwise collective bargaining must fail for want of that primary essential to every sound bargain, i.e., competent parties. The authority of the government should not be invoked in behalf of any party who, through disability in any of these respects, cannot be qualified as competent.

If we are to have collective bargaining that will be authoritative and enforceable, we must be sure that our parties not only are able to exact collection but also can be made to deliver. In this as in all other matters, power and responsibility should be inseparable.

Willard Chevalier

ENGINEERING NEWS-RECORD

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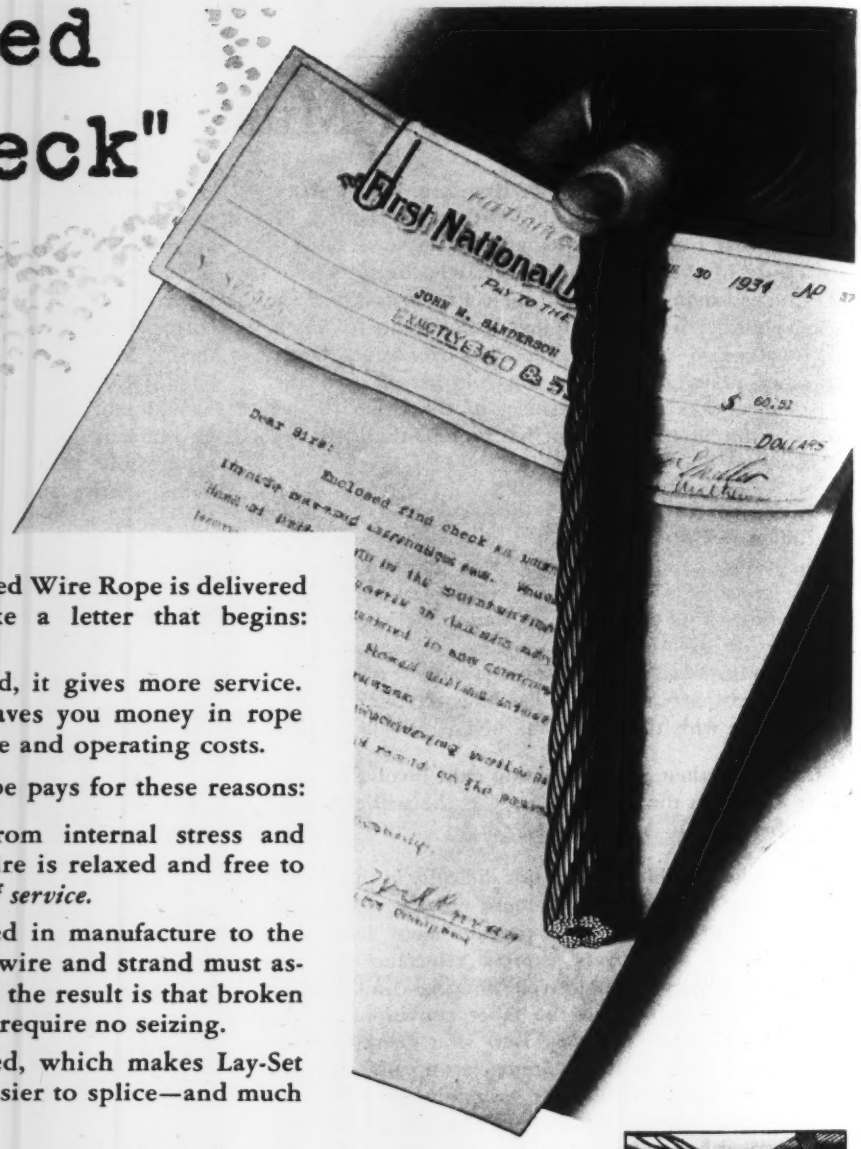
"Enclosed find check"



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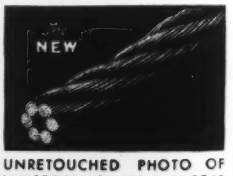

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In the News:

THE U. S. SUPREME COURT has declined to review two cases in which power companies sought to restrain municipalities from constructing public power plants.

DETROIT is to be the next battleground for slum-clearance condemnation proceedings. Approval of the Detroit project has been given by PWA, and federal officials are in Detroit planning for land acquisition "somewhere on the East Side."

IN NEW YORK a begining has been made by PWA to exercise options held on land in the neighborhood of Bushwick Ave. and Grand St., in the Williamsburg section of Brooklyn.

THE NEW MISSOURI RIVER BRIDGE at Kansas City has been officially turned over to the highway departments of Missouri and Kansas by the Regional Bridge Co., which promoted and built it with a $600,000 RFC loan. It will be opened as a toll bridge next month.

RECOMMENDATIONS by two consulting boards advise changes in the design of San Gabriel No. 1 Dam of the Los Angeles County Flood Control District, to flatten the side slopes and use quarry material that would be classed as waste, according to original specifications.

A SECOND HIGH-SPEED, light-weight train has been delivered to the Union Pacific Railway. It is an articulated unit of six cars, a motor car containing a 900-hp. diesel engine, a mail-baggage car, three sleeping cars accommodating 68 passengers in all, and a combination coach and buffet car accommodating 56.

ALLOCATION OF $1,400,000,000 of federal public-works funds to the elimination of 25,000 grade-crossings between highways and railways has been urged upon Secretary Ickes by the Security Owners' Association.

NEBRASKA has received the authority of the U. S. Supreme Court to file suit against Wyoming over the question of water rights on the North Platte River. The legality of water rights granted by Wyoming to the Casper-Alcova project are involved.

SETBACKS ON BUILDINGS, required by the Chicago zoning ordinance, have been upheld by the U. S. Supreme Court, and as a result of the test case extensive remodeling will be required on the top twelve stories of a twenty-story apartment, at a cost of $500,000.

In This Issue:

IN ELIMINATING one of the most infamous railroad grade-crossings in Kansas, state highway engineers have at the same time made an interesting contribution to continuous-girder design. In this steel structure near Wichita the superstructure of six lines of longitudinal girders is carried on a foundation consisting of independent piers under the exterior girders only. Ingenious framing of the transverse pier girders is the key to the design.

INVESTIGATION of the hydraulic properties of a creosoted-wood culvert at the Iowa Institute of Hydraulic Research has revealed that a round entrance permits a greater capacity than one with square corners. A formula for total head, consistent with observed results, was developed.

AN INNOVATION in flat-slab floors occurs in the new U. S. Appraiser's Stores Building in Baltimore. Use of a welded structural-steel "column-head" concreted into the slab permits a perfectly flat ceiling without column capitals or drops.

CONTRACTS involving 40,000,000 cu.yd. of excavation work are under way to dig the first 30 miles of the All-American Canal from the Colorado River to the Imperial Irrigation District in southeastern California. The principal features of the project are reviewed, and the present construction work is outlined.

STARTLING INEFFICIENCY in construction operations is reported in an article that presents some time-production studies on a group of small highway bridges. Machines on the jobs, which were of average character in every way, actually worked 20.2 per cent of the available time.

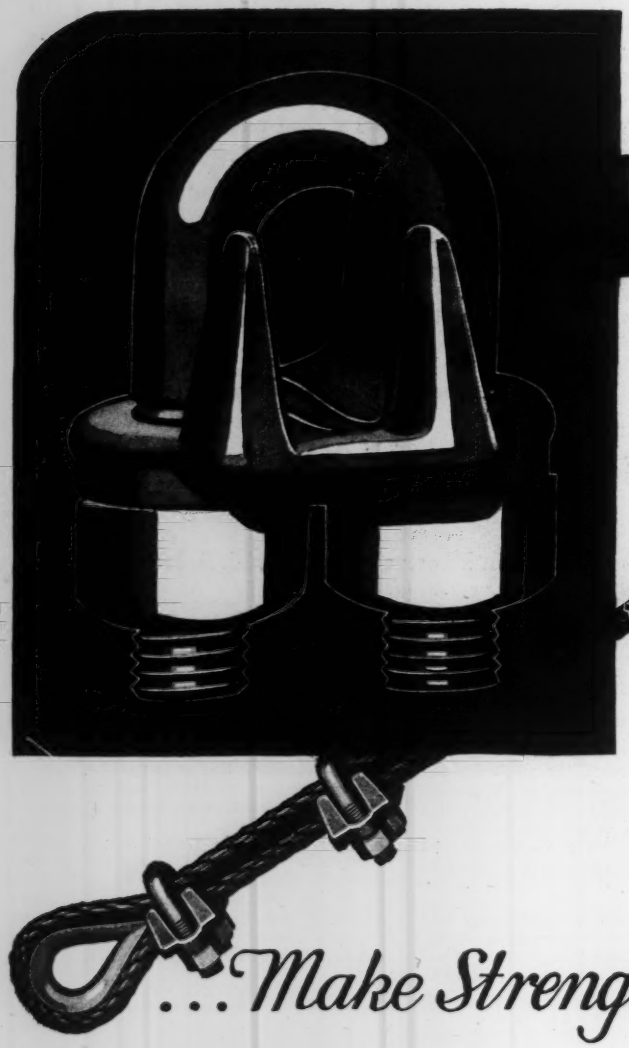
INTEREST in groundwater resources was intensified by the recent drought, and authentic data on the subject are of increasing value to engineers in the field of water supply. O. E. Meinzer outlines the geological conditions in the north-interior states affecting subsurface supplies and records first-hand information on the drought effect on these supplies.

CONSTRUCTION METHODS on mixed-in-place road surfacing for Vermont highways are reviewed. Both gravel and crushed-rock types are used, and costs run from $4,000 to $6,000 per mile.

ON A CALIFORNIA highway project through a heavy redwood forest, the logs cut from the right-of-way were used for building fills. The advantages of this particular operation are described.

Coming Articles:

BUILDING long, narrow and high walls for navigation locks within a restricted cofferdam area is always an interesting construction problem. At Montgomery Island on the Ohio River the contractor attacked the job from the air by installing three long fixed cableways to handle much of the excavation and all of the concrete. An ultra-modern concrete plant, a new type of concrete bucket and traveling steel forms with self-dumping concrete hoppers for final placement of concrete completed an equipment layout of notable effectiveness, described in an article in next week's issue.



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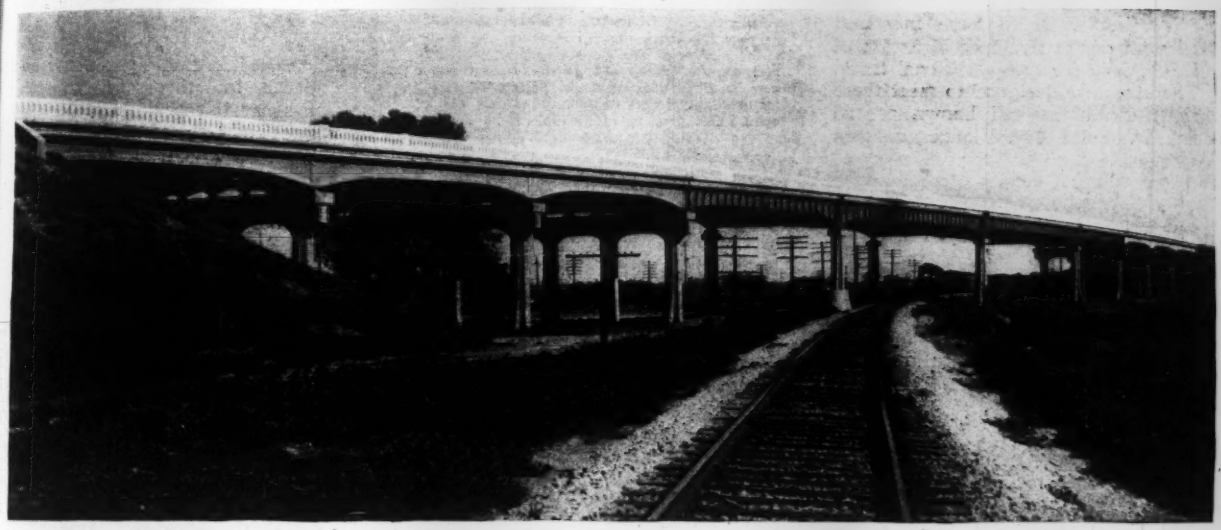


FIG. 1—THREE GROUPS of continuous spans comprise the North Lawrence Ave. Viaduct at Wichita, Kan. Independent pier columns under the exterior girders only of the steel spans permit railroad tracks to pass under the structure at an angle of 19 deg. 30 min.

Continuous-Girder Viaduct of Unusual Design

In steel highway structure at Wichita, Kan., a transverse girder carries the reactions of the interior girders to the exterior girders, which rest on independent pier columns, a type of foundation made necessary to provide for railroad tracks beneath the viaduct

By LaMotte Grover

Office Bridge Engineer, State Highway Commission of Kansas, Topeka, Kan.

A NUMBER of unique structural features were involved in the construction of the recently completed viaduct over the Santa Fe Railroad on highway route US 81 in the suburban industrial district north of Wichita, Kan. The entire improvement, which includes 1.58 miles of 40-ft. concrete pavement and several small bridges, is notable because it eliminates a grade-crossing which for years has claimed periodically a toll of human life on the most heavily traveled section of rural highway in Kansas, and also because it provides a long-needed entrance to Wichita at extreme flood stages of the Arkansas and Little Arkansas Rivers.

The importance of the improvement merited very high standards for the alignment and gradients and justified the abandoning of 1.5 miles of existing and usable pavement that was below high-water elevation. The alignment chosen necessitated an extensive relocation of the channel of near-by Chisolm Creek, but the excavated earth provided most of the material for the long approach fills to the viaduct, where borrowpits would have caused expensive property damage. Also the hydraulic properties of the creek channel were greatly improved for flood prevention.

The relocated highway intersects the railroad at an angle of 19 deg. 30 min. but is square with the viaduct piers. The use of deck-type construction and comparatively flat approach grades, consistent with the sight distance, general safety, and good appearance merited by the location, called for the use of shallow-deck continuous spans for best economy, without excessive deflections and vibration. Preliminary studies were made of a 40-ft. roadway square structure, supported at each main pier location by two independent columns, with cross-beams and pier caps omitted so that the railroad tracks could be carried between the columns. Studies were made also of a 30-ft. roadway structure that would have had to be skewed because independent

columns placed opposite each other could not have been located to permit the closest spacing of railroad tracks. The 40-ft. roadway was adopted because the increased cost under these conditions was found to be almost negligible.

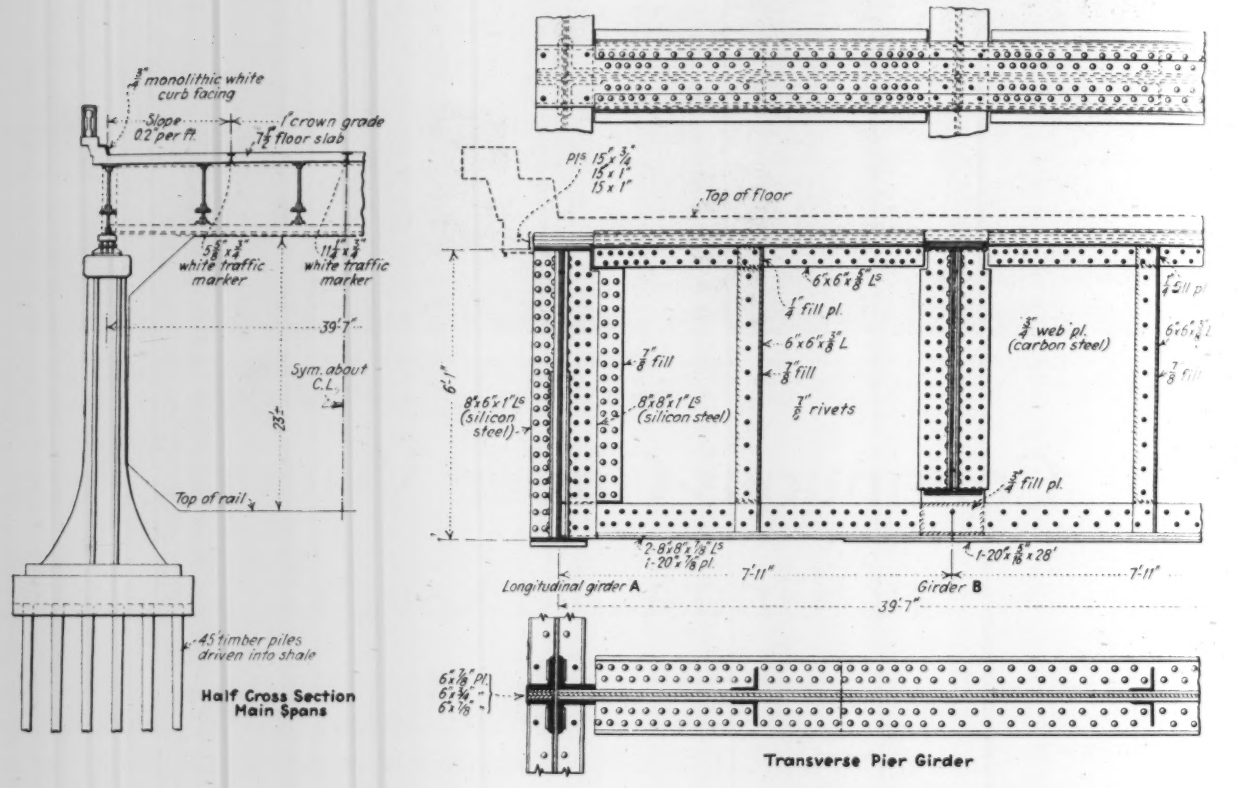
Railroad clearances were required for the existing track and three future tracks. Provision for additional future industry service tracks, although possibly desirable, would have increased the length of the structure at a rate of a 117-ft. span for each additional track.

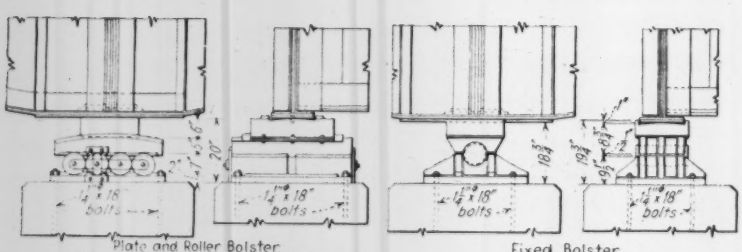
The structure designed to meet these various conditions and known as the North Lawrence Ave. Viaduct, consists of a continuous group of built-up steel deck-girder spans, 81, 117, 117 and 81 ft. in length, with six lines of girders that are haunched over the piers where maximum moments occur. The reactions of the interior girders are carried by a transverse steel girder at each intermediate pier to the main bearing devices under the exterior girders, which are directly over the independent pier columns. The main spans are flanked at each end with a continuous group of three 55-ft. concrete deck-girder spans, which places the pedestal-type abutments back just far enough to prevent the approach-fill slopes from encroaching upon the railroad ditches.

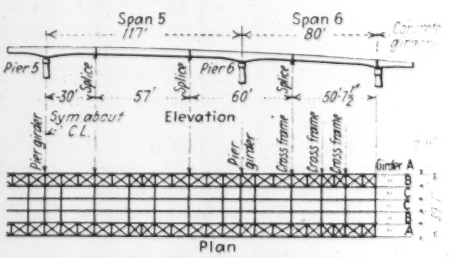
FIG. 2—STRUCTURAL-STEEL DETAILS of the continuous-girder viaduct. The transverse girder is of particularly notable design in that it carries the reactions of the interior girders to the exterior girders, which rest on the piers, and at the same time permits both the webs and flanges of all longitudinal girders to be continuous. The open holes give an indication of the erection procedure used.

Unique framing

The method of framing the transverse girders into the main girders of the steel spans is especially interesting. The flanges and webs of the longitudinal




1¼" x 18" bolts
Plate and Roller Bolster Intermediate Piers No. 4 and No. 6
Fixed Bolster Center Pier No. 5
Pier Bearing Details



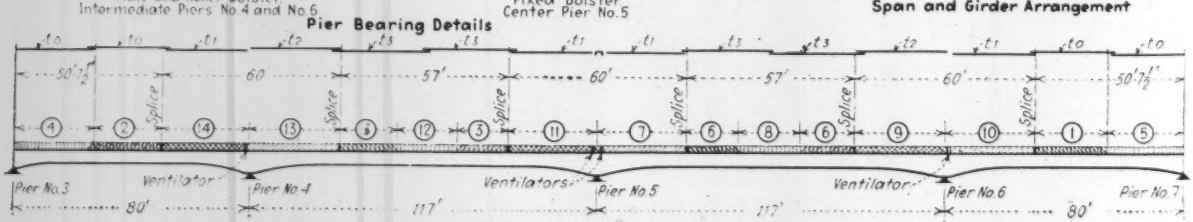


FIG. 3—THREE-COLUMN BENTS under the continuous concrete girder section where railroad clearances did not apply.

girders are run through unbroken, for the sake of simplicity and in order to avoid splicing at the points of maximum moment. The web plates of the transverse girder frame into the main girders (Fig. 2) with portions blocked out to clear the upper and lower flanges of the latter. The flanges of the transverse girder are carried entirely outside the outlines of the longitudinal main girders, to avoid splicing the latter. These flanges are designed to carry the entire bending stress of the transverse girder at low unit stresses, in recognition of the localized stresses that are caused by blocking out portions of the web adjacent to the flanges, and in order to hold down the deflection of the transverse girder. The main bearings under the exterior longitudinal girders, at the ends of the transverse girders over the columns of piers 4, 5 and 6, provide for deflections in both transverse and longitudinal directions (Fig. 2). The span length of the transverse girder was considered sufficient to warrant this provision.

Silicon steel was used for all main material of the longitudinal girders and for the flanges of the transverse girders. For these span lengths it is questionable whether the reduction in dead-load weight of the girders that was accomplished in this way is sufficient to compensate for the increased difficulty of fabricating silicon steel and the greater deflections resulting from its use. All the girders were designed with only sufficient camber to fit the vertical curve and compensate for dead-load deflections.

Because of the main pier columns being independent and unbraced, it was found necessary to reinforce them with structural-steel angle frames. Also railroad clearances would not permit increasing the size of the columns. The lacing bars for these frames were welded in place to avoid intricate detailing and fabrication.

The structure is designed for a standard H-15 loading with basic stresses of 900 and 18,000 lb. per sq.in., respectively, for concrete and carbon steel, with the further provision that a 100 per cent increase in live load and impact will not cause total stresses in excess of 1,200 and 24,000 lb. per sq.in. The allowable stresses used for silicon steel are 40 per cent greater than for carbon steel.

Erection procedure

A departure was made from ordinary methods of fabrication and erection in framing the transverse girders into the sections of the longitudinal girders over the main piers (Fig. 2). Common practice would have been to ship one or both angles loose in the cases of the connection angles between the flanges and webs of the transverse girders as well as the connection angles between the web plates of the transverse girders and the sections of the longitudinal girders to which they are connected. In order to eliminate as much field riveting as possible, the contractor chose to exercise an option that permitted both connection angles to be shop-riveted in place with unusually small clearance for entering the web plates between them in the field This clearance had to be held down to about ⅛-in. to insure a tight field connection.

The erection procedure was first to place a section of one exterior longitudinal girder and the bottom flange of the transverse girder. Then a section of the web of the transverse girder was inserted between the outstanding legs of the connection angles on the exterior girder and those of the bottom-flange connection angles of the transverse girder, both at the same time. Next a section of the first interior longitudinal girder was placed, fitting its connection angles over the edge of the section of the transverse-girder web plate. Then the next section of the web of the transverse girder was placed in the same manner as the first, and so on until the other exterior longitudinal girder was placed. Finally, the top flange of the transverse girder was placed, bringing its connection angles down over the top edges of the web plates in the manner that the case of a knife closes over the blade. All connections were heavily bolted and drifted and the bolts removed only as fast as the holes were filled with rivets, in order to secure a tight fit. Although this procedure was quite complicated and involved unusual care in assembling parts in the shop and reaming holes for field connections, the trouble was justified by the reduction in the number of field rivets. The parts fitted together quite easily in the field, no trouble was encountered in obtaining fair rivet holes, and tight connections were obtained.

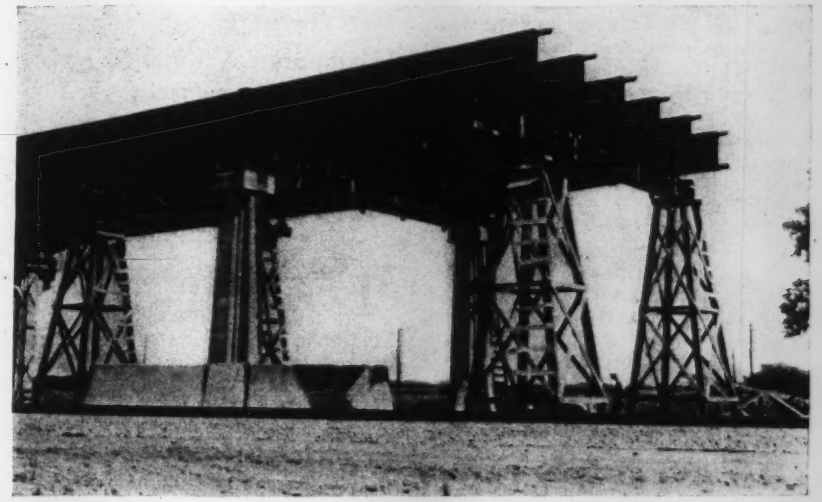


FIG. 4—TIMBER TOWERS with steel beam caps were used to support the longitudinal steel girders during erection.

The floor slab of the steel spans was placed in sections of such length that they could be struck off and finished transversely with the use of a comparatively light strike-off templet. The 40-ft. width of roadway would have necessitated the use of an extremely heavy templet if the floor has been finished traveling in a longitudinal direction; so the specifications called for full-width placement on the steel spans, to avoid unequal dead-load deflections of the interior girders. These sections of floor slab and corresponding sections of the curbs were placed in such a sequence as to obtain almost the full dead-load negative moments before the concrete was placed in the sections over the piers, in order to eliminate cracks in the curbs and floor slab at these points of maximum negative moment.

The computed deflections of the exterior girders under dead load were enough greater than those of the interior girders to justify calling for leaving some of the connections of the

cross-frames in the exterior bays loosely bolted until the floor slab had been placed, so that the dead load would be properly distributed. But in order to avoid returning to the job to rivet these connections, the procedure adopted during construction was to jack initial deflections into the beams with a transverse beam blocked down from the interior girders on the under side. The cross-frames were then fully riveted with the girders deflected. Final deflections of the steel girders, measured under full dead load, agreed very closly with those computed under the assumption of no composite action with the floor slab.

Special details

A transverse ventilator is provided at the highest point in each of the spans over the railroad tracks to facilitate the escape of flue gases. This precaution against corrosion was thought to be justified by the probability that switching tracks will be installed under the viaduct in the future. A continuous line of wrought-iron plates 4 ft. wide is installed over the existing track as a protection against direct blast, and steel angles with one leg downstanding are riveted along each edge of the blast plates to form baffles to aid in condensing moisture from the locomotive flue gases before they come into contact with the members of the viaduct.

Permanent white concrete traffic markers are constructed monolithically with the floor slab, to divide the roadway into four lanes. The lower portions of the curbs are faced with white concrete, and white cement was used for the hand-rails and posts. The white markers furnish a much better contrast with the concrete of the floor than black painted markers such as are used on the pavement approaches. Conduits are provided for a future intsallation of electric-lighting equipment. The posts upon which lighting standards will be installed are provided with anchorbolts for the standards and are capped temporarily with steel plates held in place with dome nuts. When these plates and nuts are removed, a sufficient length of threads will be exposed to splice on extensions to the anchorbolts with hexagonal couplings.

Cost and administration

The cost of the entire structure was $99,445, or about $136 per linear foot and $3.40 per sq. ft. The quantities of main materials involved were 378 tons of structural steel, 185 tons of reinforcing bars and 2,300 cu.yd. of concrete.

The structure was designed in the office of the state highway commission, the steel spans by Charles Turnipseed, T. W. Oliver and R. W. Mason, and the concrete spans by I. D. S. Kelly and George L. Epps, under the direct supervision of the writer and his assistant, Paul G. Martin. O. J. Eidmann is engineer of design of the state highway commission. The structural steel of the main spans was fabricated by the Kansas City Structural Steel Co., and that for the concrete-pier reinforcement by the Ben Sibbitt Iron & Foundry Co., Wichita, Kan. The bridge was constructed by C. E. Gray, general contractor, Emporia, Kan., under the supervision of C. M. Barber, resident engineer, with E. S. Elcock, special representative of the state department of design. W. V. Buck is state highway engineer, and H. D. Barnes is engineer of construction. (Note—Since this was written Mr. Buck has resigned to take a position as senior highway engineer for the U. S. Bureau of Public Roads in Ohio, and Mr. Barnes has been promoted to the position of state highway engineer.)

Capacity of Creosoted-Wood Culverts Studied

Laboratory investigation shows round entrance gives greater capacity than a square entrance for a given head—Roughness factors determined

By F. T. Mavis
Associate Director in Charge of Laboratory, Iowa Institute of Hydraulic Research, Iowa City, Iowa

TESTS of a laminated, creosoted-wood box culvert were recently completed at the Iowa Institute of Hydraulic Research, with the object of determining the roughness factor for the culvert and the capacity under different heads. The culvert was 2 ft. square inside dimensions and 32.5 ft. long. It was made up of creosoted-wood stock $1\frac{1}{4}$ in. thick and $2\frac{5}{8}$ in. wide nailed together in units about 4 ft. long with the narrow edge normal to the direction of flow. Fig. 1 shows the culvert as it was being installed in the river channel of the hydraulics laboratory.

The general arrangement of the culvert and testing apparatus is shown in Fig. 2. The river channel in which the tests were made is 10 ft. wide and 10 ft. deep. The flow was controlled by a head gate at the university dam, and the discharge was measured by means of a suppressed weir 10 ft. long with a level sharp crest 3.2 ft. above the bottom of the approach channel. The head on the weir was measured by a hook gage, and check observations were made on a staff gage graduated to hundredths of a foot.

A watertight bulkhead was built around the upstream end of the culvert to a height of 5 ft., and all joints were calked with roofing cement and oakum. The bulkhead was located 18 ft. below the weir and about 10 ft. below a system of wood baffles in the approach channel.

Eight pairs of piezometer connections were made through the side walls of the culvert at an elevation 8 in. above the invert. The piezometers were made of $\frac{1}{8}$-in. galvanized iron pipe cut to lengths of about 4 in. and driven from the inside of the culvert through holes bored for that purpose. The inside edge of each piezometer was square, flush with the inner surface of the culvert, and free from burrs. The location of the piezometers is shown in Fig. 2.

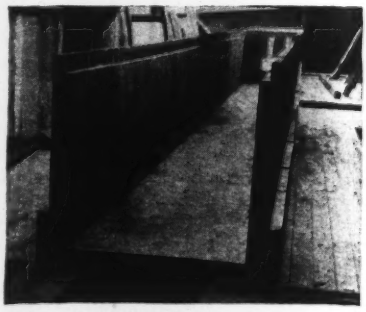


FIG. 1—ASSEMBLING the creosoted-wood box culvert preparatory to test.

The piezometers were connected by $\frac{1}{4}$-in. rubber tubing to stilling wells mounted on the side wall of the flume. Connections were made so that the two piezometers that were opposite each other in the culvert were connected to the same stilling well. A hook gage mounted on a level track above each battery of four stilling wells was used to determine elevations of the hydraulic grade line.

The tailwater level was controlled by a bulkhead 8 ft. below the lower end of the culvert, and its height was adjusted as required, to maintain the tailwater level above the inner top surface of the culvert box. The tailwater and headwater levels were read by staff gages graduated to hundredths of a foot.

Test procedure

The head gate at the dam was regulated to obtain the desired discharge for a given test, and an interval of time varying from 10 to 30 min. was allowed for conditions to become steady. As soon as steady flow conditions had been

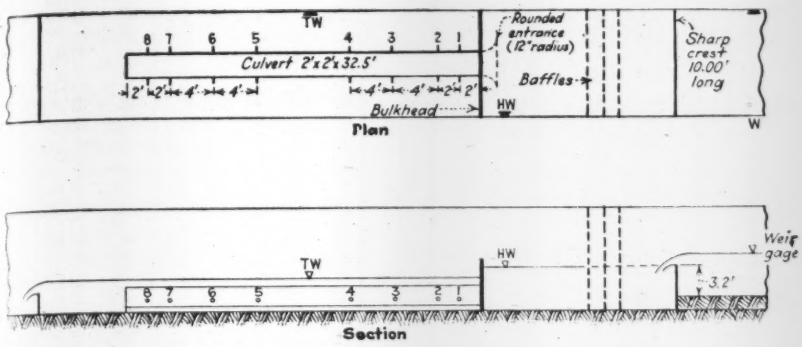


FIG. 2—ARRANGEMENT OF CULVERT and testing apparatus. Numbers denote location of piezometers.

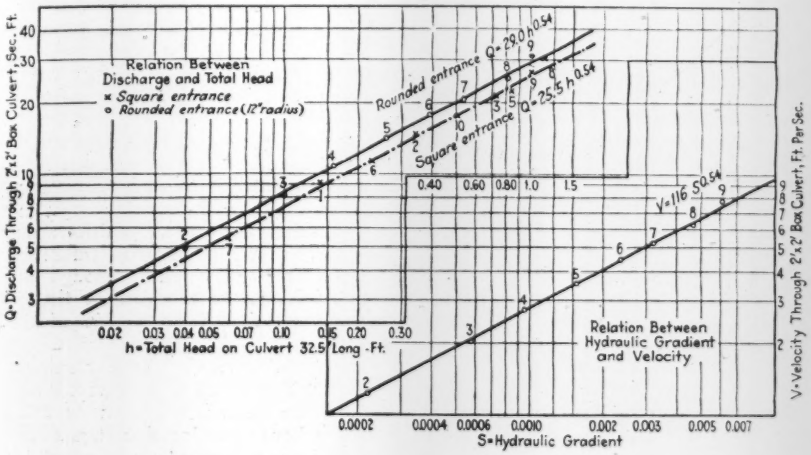

Relation Between Discharge and Total Head
× Square entrance
○ Rounded entrance (12" radius)
Rounded entrance Q=29.0 h^0.54
Square entrance Q=25.5 h^0.54
Q=Discharge Through 2'x2' Box Culvert, Sec. Ft.
h=Total Head on Culvert 32.5' Long-Ft.
V=116 S^0.54
Relation Between Hydraulic Gradient and Velocity
V=Velocity Through 2'x2' Box Culvert, Ft. Per Sec.
S=Hydraulic Gradient

FIG. 3—RESULTS OF TESTS showing relation between discharge and total head; also the hydraulic gradient and velocity comparison.

reached, as determined by stable water elevations in the stilling wells, the procedure was as follows:

One observer read the head on the weir by determining not less than three pairs of readings with the hook gage. These readings were taken alternately at high and low points corresponding to small surges in the approach channel to the weir. These surges seldom exceeded 0.01 ft., and it is believed that the average of all high and low readings was precise within 0.005 ft.

The second observer read the elevations of water surfaces in stilling wells 1, 2, 3 and 4, and he also read the headwater staff gage. The third observer read water-surface elevations in stilling wells 5, 6, 7 and 8, and he read the tailwater staff gage. Not less than three sets of observations were made in each test, the maximum tolerance being about 0.005 ft.

Under conditions of high discharge through the culvert, vortices formed at the entrance. These vortices were controlled by floating a small wood raft in the headwater pool.

Data were obtained for two entrance conditions: (1) a square-cornered entrance flush with the upstream face of the bulkhead, and (2) a quarter-round entrance of sheet metal tangent to the four inner faces of the culvert and shaped to a radius of 1 ft.

Analysis and results

Fig. 3 shows the relation between the total head and the discharge through the culvert with both square and round entrance. The tests indicate that for a given head the capacity of the culvert with the round entrance is about 14 per cent greater than the capacity of the same culvert when it has a square entrance.

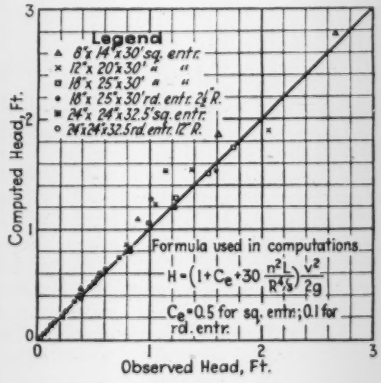

Legend
8"x 14"x 30" sq. entr.
12"x 20"x 30" " "
18"x 25"x 30" " "
18"x 25"x 30" rd. entr. 2½" R.
24"x 24"x 32.5" sq. entr.
24"x 24"x 32.5" rd. entr. 12" R.
Formula used in computations
H=(1+Ce+30 n²L/R^4/3) V²/2g
Ce=0.5 for sq. entr.; 0.1 for rd. entr.
Computed Head, Ft.
Observed Head, Ft.

FIG. 4—COMPARISON between observed and computed heads.

The hydraulic grade line was plotted for each test performed on the culvert with the round entrance, and values of Manning's n and Williams-Hazen's C were determined for each test in which the culvert was flowing completely full. The data indicated for the particular tests that the mean value (0.0105) of the coefficient n in the Manning formula

$$V = \frac{1.486}{n} R^{2/3} S^{1/2} \qquad (1)$$

has an average absolute error of about 4 per cent, while the coefficient C (136) in the Williams-Hazen formula

$$V = 1.32\, C\, R^{0.63} S^{0.54} \qquad (2)$$

has an average absolute error of about 1½ per cent.

This fact is interesting to record, although in the particular instance it would appear to be of no practical significance.

Hydraulic grade lines based on the tests of the culvert with the square entrance reflected a non-uniform velocity distribution over about half the length of the culvert. They were not used to determine cofficients in the Manning or Williams-Hazen formulas.

The head loss at entrance for a given discharge was determined by deducting from the total head on the culvert the sum of the velocity head and the friction head loss calculated on the basis of the coefficients determined for the formulas above. The median value of head loss at entrance was 0.5 ($V^2/2g$) for the culvert with the square entrance and 0.1 ($V^2/2g$) for the culvert with the round entrance.

The tests may be represented by the following formula, which, for simplicity, is based on the Manning formula:

$$H = \left(1 + C_e + 30\frac{n^2 L}{R^{4/3}}\right)\frac{V^2}{2g} \qquad (3)$$

in which,
H = total head on culvert, ft.; C = entrance loss coefficient (0.5 for square entrance, 0.1 for round entrance); n = Manning's coefficient,—0.0105 in these tests; L = length of culvert, ft.; R = hydraulic radius, ft.; and $V^2/2g$ = velocity head, ft.

Fig. 4 shows a comparison of heads calculated by formula (3), with corresponding heads observed in the tests by the writer and in tests made at the University of Iowa in 1927 by the late Prof. F. A. Nagler.

The foregoing tests were made for the Wheeler Lumber Bridge and Supply Co. of Des Moines. Prof. J. W. Howe, E. Soucek and E. W. Thomas, of the Iowa Institute of Hydraulic Research, assisted in the installation and testing.

All-American Canal Project Started on 30-Mile Section

Contracts totaling $5,000,000 under way, involving 40,000,000 cu.yd. of excavation—Canal to convey water from Colorado River to Imperial and Coachella Valleys in southern California for irrigation

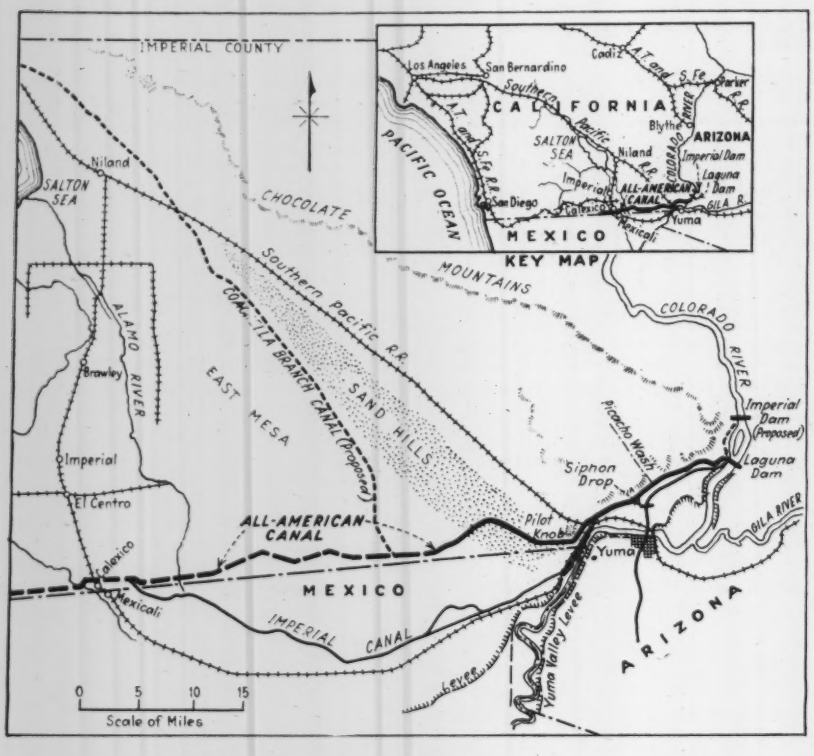


FIG. 1—CANAL LOCATION which provides the All-American route for delivering Colorado River water to Imperial and Coachella Valleys for irrigation. The solid part of the line at the east end indicates the 30 miles now under contract.

WORK has begun on the excavation of 40,000,000 cu.yd. of material to complete the first 30-mile section of the All-American Canal, which will convey a 10,000 sec.-ft. supply of Colorado River water to the Imperial Valley and Coachella Valley in the extreme southeast corner of California for irrigation, by a route lying entirely within the United States, in accordance with one of the major provisions in the Boulder Dam Act approved in 1928. The work is being carried out by the Bureau of Reclamation for a cost not to exceed $38,500,000, and the federal government will be repaid, according to a contract with the Imperial Irrigation District, over a 40-year period, without interest, under the usual provisions of the Reclamation Act. The present project does not include the 80-mile branch to the Coachella Valley, and a separate contract must be negotiated with the Coachella Valley County Water District, and additional funds provided before the work on this branch can be undertaken.

For more than 25 years the supply of water to irrigate the 450,000 acres under cultivation in the Imperial Valley has been conveyed through the Imperial Main Canal, which diverts water from the Colorado River a few miles below Yuma, Ariz., and runs through Mexican territory (Fig. 1) for almost 50 miles before returning to the United States near Calexico, Calif. The complications arising from this location in foreign territory, as to operation, maintenance and water rights, have kept the All-American Canal constantly in the minds of the Imperial District irrigators for many years. The project finally became a reality when it was incorporated in the Colorado River development program authorized in the Boulder Dam Project Act, approved by Congress Dec. 21, 1928.

The All-American Canal will divert water from the Colorado River at a point about 5 miles above Laguna Dam (Fig. 1), which is the diversion structure of the Yuma project in Arizona. Present plans for the diversion structure for the All-American Canal provide for the floating type of dam resting on unstable foundations, as used in irrigation work in India, commonly referred to as the Indian weir. The structure would be about 1,700 ft. long and would raise the water surface of the Colorado River about 22 ft. To alleviate the serious silting problem in the canal, which is one of the outstanding difficulties in the conveyance and distribution in the present system, desilting basins will be provided, with facilities for sluicing the silt back into the river.

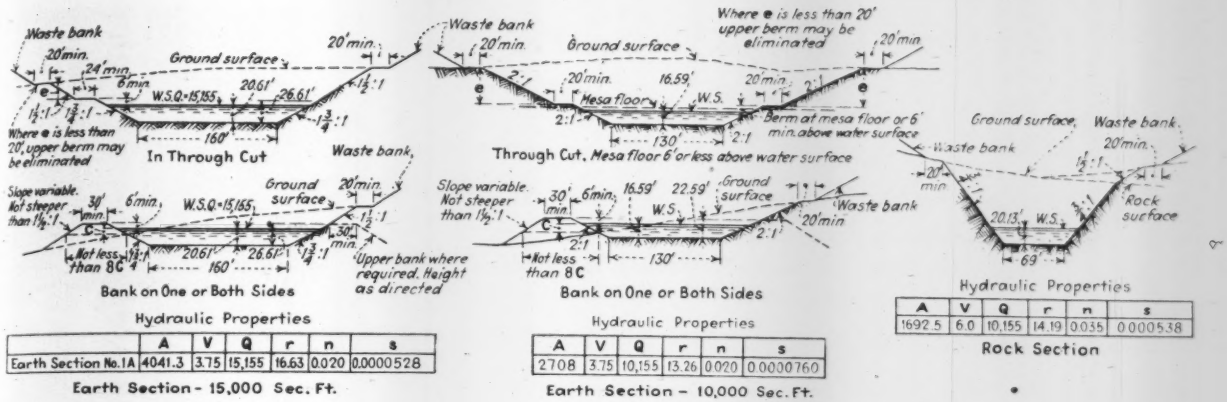
About 5 miles below the point of diversion the All-American Canal passes close to the river near the intake of the Yuma Canal, and the latter canal is to be relocated at this point for a distance of about 2,200 ft. Below this point the canal parallels the Yuma Canal for about ten miles to the Siphon Drop, where the Yuma Canal turns south through the town of Yuma to the district that it irrigates on the Arizona side of the river.

The All-American Canal continues for about 7 miles in a southwest direction to the landmark known as Pilot Knob, where the location again approaches the river and plans called for diverting 3,000 sec.-ft. back into the river as a power development.

The canal lines continue about 15 miles, in general paralleling the international boundary line, to the point where the Coachella Valley branch turns off. The main canal continues on to connect with the present distribution system of the Imperial District.

The canal capacity is 15,000 sec.-ft. (about 70 per cent of the average flow of the Colorado River at Boulder Dam) from the diversion dam to the Siphon Drop, where 2,000 sec.-ft. will be diverted into the Yuma main canal. The 13,000-sec.-ft. capacity is maintained from the Siphon Drop to Pilot Knob, where the 3,000-sec.-ft. power diversion will be made and a 10,000-sec.-ft. capacity is maintained westward for the irrigation supply to the Imperial and Coachella Valleys. The Coachella Valley branch canal will have an initial capacity of 1,500 sec.-ft. where it leaves the main canal. The city of San Diego, Calif., is negotiating for a 155-sec.-ft. capacity in the canal to augment the present municipal water supply by a conduit that would take off from the west side of the Imperial distribution system.

With the exception of about $\frac{1}{4}$ mile, the present 30 miles of canal excavation now under contract are in earth, and the cross-section is the usual trapezoidal



	A	V	Q	r	n	s
Earth Section No.1A	4041.3	3.75	15,155	16.63	0.020	0.0000528

A	V	Q	r	n	s
2708	3.75	10,155	13.26	0.020	0.0000760

A	V	Q	r	n	s
1692.5	6.0	10,155	14.19	0.035	0.0005.38

FIG. 2—CHARACTERISTICS of the canal in earth and rock sections.

shape with a water depth of about one-eighth the bottom width. The side slopes are 1½ or 2 to 1, n is assumed as 0.020, and a mean velocity of 3.75 ft. per sec. is used.

The maximum capacity section (15,000 sec.-ft.) extends for 15.5 miles below the proposed diversion dam to the Siphon Drop, where 2,000 sec.-ft. is delivered to the Yuma Canal. The upper 5.5 miles of this section is not included in the present contract. For this distance the canal has a bottom width of 160 ft., a water depth of 20.61 ft. and a 6-ft. minimum freeboard. For the 10,000-sec.-ft. capacity section, these dimensions are reduced to a 130-ft. bottom width and a 16.59-ft. depth of flow.

In the 1,800-ft. section where rock is encountered, the 10,000-sec.-ft. canal has a bottom width of 69 ft. and a water depth of 20.13 ft., with side slopes of ¼ to 1. The canal section is unlined, and n is assumed to be 0.035; a velocity of 6.0 ft. per second is used.

Location problems

The most serious construction, and hence operating, problem occurs in the 10½-mile section where the canal passes through a typical desert region of sand hills and dunes. The deepest cut into this sand-hill area is more than 100 ft., and the loose dune sand is about 80 ft. depe. In this location the canal will not be lined with concrete. Instead, efforts will be concentrated on provisions to prevent the desert sand from blowing into the canal, with subsequent removal of the loose sand by suction dredges as may be necessary.

The section through this sand-hill region has been designed to provide a mean velocity of 4.5 ft. per second, at full capacity, which is intended to be non-scouring and non-silting. For those short sections where the water section is located in the finer sand, and possibility of scour is evident, the canal will be excavated about 1½ ft. deeper than grade level, and this space will be refilled with screened gravel to resist scour.

Several methods for preventing sand from blowing into the canal have been outlined. These include: (*a*) growing vegetation in a zone on either side of the canal by irrigation from small pipe lines; (*b*) spraying the sand with crude oil; (*c*) covering the dunes on either side of the canal with material from the excavation operations, which is too coarse to be blown by the winds; and (*d*) excavating a 15-ft. berm on each side of the canal at the level of the mesa floor. By the use of one or more of these methods it is expected that the quantity of sand blown into the canal can be kept to a minimum.

In addition to the major construction problem presented by the section through the dunes, there are two main-line railroad crossings to be provided, as well as several highway bridges. These structures will be built under separate contracts. Where the main canal cuts through the present Imperial Valley distribution system, there are seventeen existing ditches to be bypassed, as well as the problem of extending the canal to the town of Calexico to reach its terminus at the west side of the valley. There are several places where culverts and siphons must be provided.

The Coachella Valley branch, which is not to be undertaken at present, offers a different problem. The topography requires the canal line to cross the mouths of 160 washes that are subject to occasional severe floods resulting from heavy cloudbursts. These washes must be crossed with siphons, or else culverts provided. Present plans call for a concrete lining for the last 47 miles of this branch canal, which is 130 miles long.

At the present time the Imperial Irrigation District irrigates about 450,000 acres from its existing canal system. The district comprises 512,000 acres in the valley, which varies in elevation from sea level to a minimum of 250 ft. below sea level at the Salton Sea. The principal crops raised in the district are alfalfa, canteloupes, lettuce and fruits.

In the Coachella Valley, at the present time, about 16,000 acres are under cultivation, with the water supply pumped from wells. There is no general canal or irrigation system in the valley, which is estimated to contain about 150,000 acres of irrigable lands. The total irrigable land under the All-American Canal is about 1,000,000 acres, but there is no plan to bring new land under irrigation at the present development.

Power development at Pilot Knob, where 3,000-sec.-ft. of water will be dropped back into the Colorado River, and at several other points where drops occur along the canal line, is not provided for with the funds now available.

Contract provisions

The 30.5-mile section on which contracts have been let extend from a point about 4½ miles below the diversion point to a point within one mile of the Coachella Valley branch diversion. For the purpose of bidding, this distance was divided into seven schedules. Of these, six contain from 5,000,000 to 7,000,000 cu.yd. of common earth excavation each, and one (Schedule 7), which consisted of about ¼ mile excluded from Schedule 4, contains about 500,000 cu.y.l. of heavy rock excavation. This distinction made possible the separate bidding for the rock work by contractors having equipment especially suited.

When bids were opened on June 7, eighteen bids had been received for all or part of the schedules. The bid for the six schedules of common excavation, totaling 39,389,000 cu.yd., was let to W. E. Callahan, H. Gunther and J. P. Shirley, St. Louis, for a combined bid of $4,859,587 and a unit price of $0.1225c. per yard for the common material. Schedule 7, the rock excavation, was awarded to John Giffiths Co., Los Angeles, on a bid of $226,800 for the excavation of 528,000 cu.yd. of rock, or a unit price of $0.42 per cubic yard. The complete unit bid figures were noted in *ENR*, June 28, 1934, p. 856.

The work is classed as a federal project under Title II of the National Recovery Act, and the contractor is required to operate in accordance with PWA form No. 51. Because of the isolated location labor will be permitted to work 40 hours per week. Wage rates noted in the specifications were: skilled labor $1.10, and unskilled labor $.45 per hour.

New Type Flat-Slab Floor in Baltimore Building

In U. S. Appraiser's Stores Building column capitals and drop panels are eliminated by using a structural-steel column-head assembly concreted into the slab—Results of load test

By Walter H. Wheeler
Consulting Engineer, Minneapolis, Minn.

REALIZING the many advantages and great economy of flat-ceiling floor construction, the writer has developed, over a period of years, and has patented a flat-slab design in which the usual flared concrete column capital is replaced by a structural-steel member or column head enclosed within the depth of the slab. This steel member is used either in combination with steel columns or reinforced-concrete columns. Ordinarily no drop panel is used, although a drop may be used if desired.

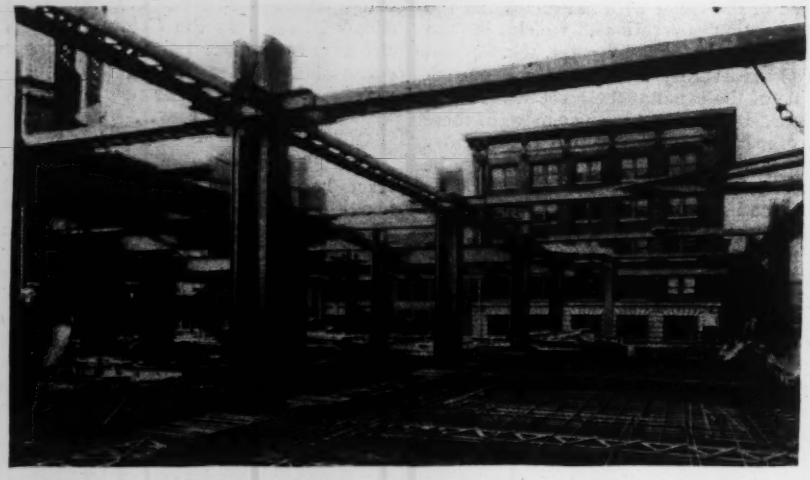


FIG. 1—STEEL COLUMN HEADS joined by light struts as used in flat-slab design of U. S. Appraiser's Stores Building in Baltimore.

In the new U. S. Appraiser's Stores Building, Baltimore, Md., the steel column head is used in combination with steel columns. The building has a complete structural-steel frame, except that the interior beams and girders are omitted. Light steel struts connect the steel column heads, which in turn are rigidly connected to the steel columns. These struts are also enclosed within the flat concrete floor slabs. In this case they remained in the structure, although they may be removed as concrete work progresses and be used over and over. They are not considered in the slab design.

The wall spandrels are I-beams, with web connections and top and bottom angles for windbracing. The elevator shafts and stair wells are framed with I-beams and channels in the usual way. There are two windbracing bents with diagonal bracing at the freight-elevator shaft. Because of the stiff floor construction, the windbracing was computed on the basis of 50 per cent increase in unit stresses, instead of 25 per cent as provided in the U. S. Navy building code, which was used for both steel and concrete design.

The building is about 100x170 ft. in plan. There is a basement and sub-basement and eight stories above the ground, but the foundations, columns and windbracing are designed for four additional stories in the future. There is a large roof house with pitched roof that rises 40 ft. above the ceiling of the top story. The floors are all designed for 250 lb. per sq.ft. live load plus 25 lb. for finish, except the front two bays of the second and third floors and the front bay of the fourth, fifth and sixth floors, which are designed for 150 + 25. The column spacing is as shown in Fig. 3.

The floor slabs are two-way flat slabs designed in the usual way, except that the design of the wall panels is modified slightly to compensate for the omission of column capitals on the wall columns. The steel column heads are treated like standard flared concrete capitals in the slab design and are themselves designed to transmit the total slab load to the columns. The column heads are fabricated into one unit by electric welding and were attached to the columns at the shop.

FIG. 2—SMOOTH CEILINGS devoid of column capitals or drop panels characterize the flat-slab design.

The specifications provided that two tiers or four stories of steel might be erected ahead of the concrete. This procedure was followed, a single derrick set-up over the elevator shaft being used. Four stories were erected from each setting of the derrick.

Steel panel forms were used for the concrete floor slabs, supported on adjustable shores. Approximately two days were required to erect forms, two days to place reinforcing, conduits, sleeves, inserts, etc., and one day to pour concrete. The concrete in each floor slab was poured in a continuous run of thirteen to fourteen hours. The floor slab, column fireproofing and beam fireproofing of each story required about 720 cu.yd. of ready-mixed concrete. A 2,500-lb. concrete was specified for the 250-lb. floors and a 2,000-lb. concrete for the 150-lb. floors, so that the slab thickness was uniform throughout. Above the third floor an electric vibrator was used. No voids or rough spots were found in the concrete on which the vibrator was used, although a few were evident where hand tamping was done.

Load test on floor

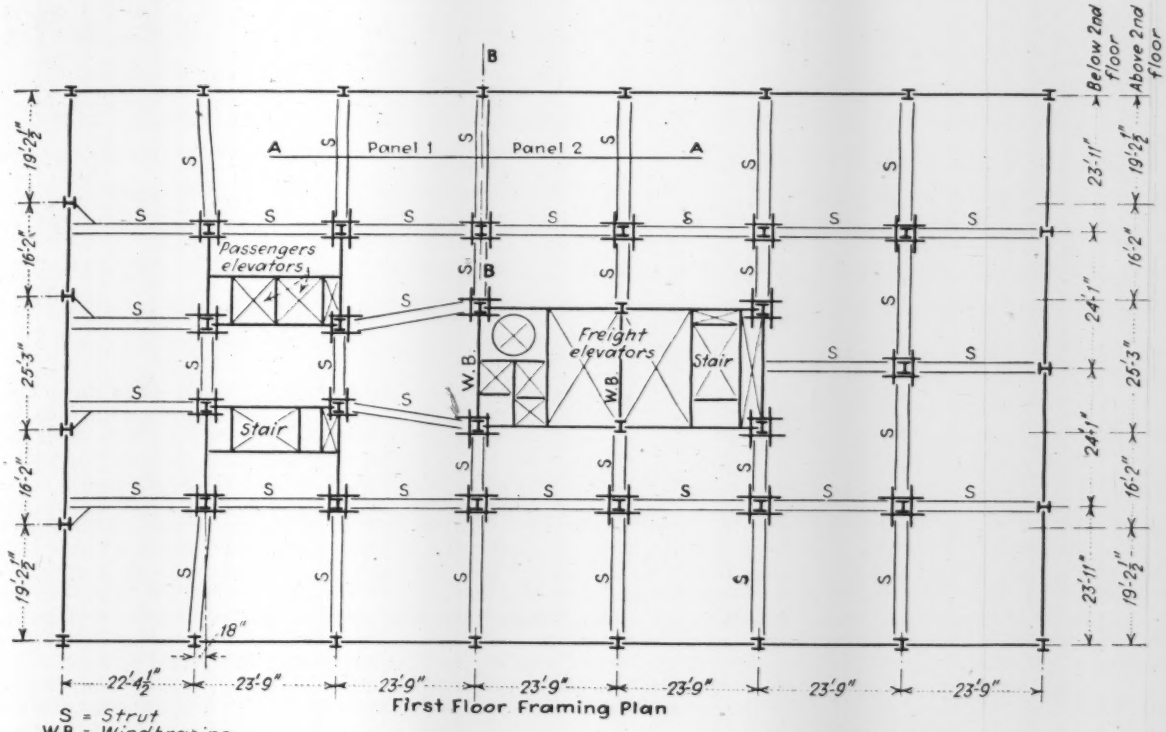
About 90 days after the first floor slab was cast, two of the wall panels on the first floor were tested in accordance with specification requirements. Pig iron, cast-iron elevator weights and a few steel billets were used to make up the 142 tons of load which was placed in such a manner that there was no possibility of arch action. As the load was placed it was concentrated so that its effect upon the slab was greater than that of a uniform load of 500 lb. per sq.ft. Fig. 3 shows the location of the panels that were tested.

Deflections were measured at 25 locations between steel points set in the

basement floor and ceiling, using an Ames dial and reading to thousandths of an inch. Steel and concrete deformations in the slab were measured at 107 gage lines (45 on the concrete, 60 on the reinforcing steel and two on the steel column head) with a Berry strain gage, reading to 1/400,000 in. per inch. Seven sets of double readings were taken, including one set immediately after the load was removed.

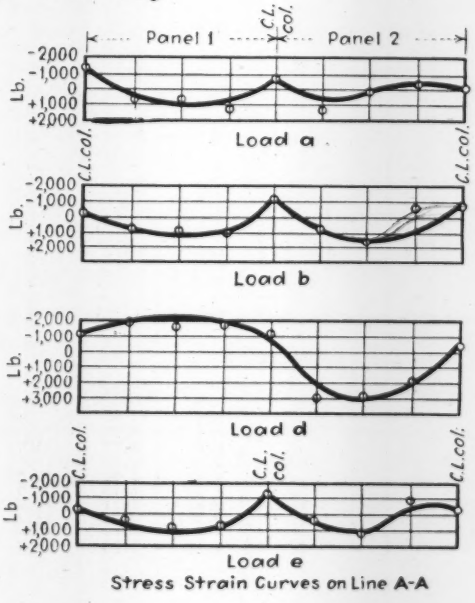
The deflections under different loading conditions are shown in Fig. 3 along line AA. The maximum deflection under the double live-load test was 0.2 in. at the middle of the 24-ft. panel, or 1/1440th of the span. The immediate recovery after the load was removed was about 66 per cent, indicating at least 75 per cent recovery within 24 hours after removal of the load. The stress-strain curves shown in Fig. 3 for different load conditions along lines AA and BB are typical of the low stresses found in both steel and concrete. The maximum steel stress and also the maximum concrete stress was at the outside wall. The first-floor slab is rigidly connected to the heavy reinforced-concrete basement wall, so that the stress is higher than if the slab framed into a spandrel beam that could twist or into a column that could bend. The highest stress measured in any reinforcing bar except at the outer wall was 6,825 lb. per sq.in. The highest stress found in the concrete on the top of the slab was 443 lb. per sq.in. The maximum stress in

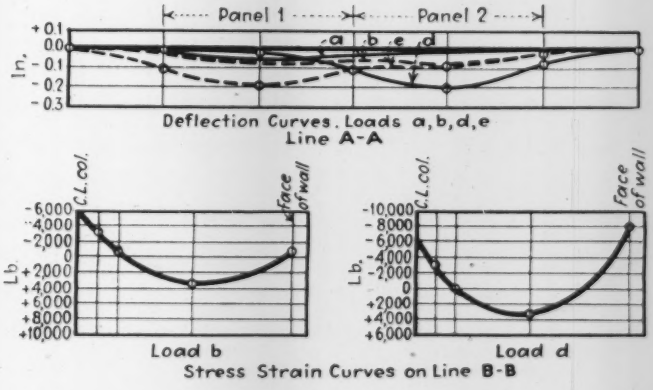
FIG. 3—PLOTTED RESULTS of load-test curve, with first-floor framing plan, showing locations of panels loaded with the equivalent of more than 500 lb. per sq.ft.



Load Schedule

Load	Panel 1	Panel 2
a	145,500 lb.	00
b	145,500	139,000
d	00	284,500 lb.
e	284,500	00





the concrete on the bottom of the slab around the columns was 510 lb. per sq.in. The measured stress in the column strip between panels 1 and 2 at the wall on one of the gage lines was 8,400 lb. per sq.in. The stress in the concrete on the bottom of the slab under the same point was 832 lb. per sq.in. The apparent residual stress in the concrete at this gage line after the load was all removed was 390 lb. per sq.in. Dead load would add less than 25 per cent to these unit stresses.

Reference is made to the stress-strain curve of load *c* as compared with load *d*. It will be noted that the slab had not fully readjusted itself to load *c*. When it did a curve similar to the curve for load *d* might be expected. Likewise the apparent residual stress of 390 lb. per sq.in. in the concrete would no doubt reduce over a period of time. But assuming a residual deformation equal to a stress of 390 lb., the net deformation due to the test load equals a stress of 442 lb. per sq.in. in the concrete. The apparent residual stress in the reinforcing was 1,500 lb. per sq.in., leaving a net stress due to the test load equal to 6,900 lb. per sq.in. in the steel.

Using a modulus of elasticity of 30,000,000 for the steel and 3,000,000 for the concrete, the average measured stress in the reinforcing steel was 2,211 lb. per sq.in., and in the concrete was 230 lb. per sq.in. The maximum measured stress in the steel column head was 7,625 lb. per sq.in.

Taylor and Fisher, Wm. F. Stone, Jr., were associated architects for the building, for which Henry Massart is the structural engineer. The writer was consulting structural engineer on the project. The construction work was supervised by Chas. A. Sloan, construction engineer, and Rolin F. Officer, associate construction engineer of the Treasury Department. All drawings and specifications were checked and approved by the Office of the Supervising Architect of which T. C. Brooks is superintendent of structural engineering. Pike & Cook, Inc., Minneapolis, was the general contractor. Steelwork was fabricated by McClintic-Marshall Corp. and erected by Karl Koch Erecting Co., New York City.

A Study of Job Production on Small Road Bridges

Records of pile casting and driving and of concrete production on eight concrete road bridges indicate that only about 20 per cent of available time was employed in income-producing work

By D. V. Purinton

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THE PRODUCTION RATES obtained in recent years on small highway jobs have been most erratic and, in spite of the efforts of the Bureau of Public Roads and numerous other engineers to direct attention to the situation, there has been little change. The fact that most highway work is handled by small organizations where the limited overhead does not permit intensive study of the problem by properly qualified men has encouraged the following study. This study is not a criterion of the performance on all highway projects. There are organizations under the direction of trained men that function with real efficiency, but there are also those that perform in the manner recorded.

The project observed was an NRH project consisting of seven reinforced-concrete deck-girder bridges and one double 10x13-ft., 34-ft. reinforced-concrete box culvert.

For purposes of future reference, data on the observed structures are tabulated as follows:

No. of Structures	No. of Spans	Span Lgth., Ft.
1	8	28½
2	4	28½
3	5	28½
4	5	28½
5	10	28½
6	Double box culv.	
7	3	46
8	7	28½

All of the 28½-ft. spans were supported on reinforced-concrete five-pile bents, rising from 4 to 11 ft. above the ground; and Bridge 7, with three 46-ft. spans, was an overpass on 36-ft. reinforced-concrete piers rising from 22.5 to 28 ft. above the ground. Only five of the spans were erected over water. The structures were distributed along a 12-mile highway relocation, and work was started in the latter part of October, 1933, and continued through the winter except when interrupted by rains.

The work was under the general supervision of a district superintendent, who visited the job about twice a week, and it was in direct charge of two job superintendents, who supervised the

TABLE I—PRODUCTION ANALYSIS OF CONCRETE PILE-CASTING OPERATIONS

Bridge Number	Number of Piles Cast	Total Lin.-Ft. Cast	Total Cu. Yd. Concrete in Piles	Actual Mixing Time Used	Man Hours Used: Net Mixing Hours	Man Hours Used: Lost Minor Delays	Man Hours Used: Total Man-Hr. Used	Average Production: Cu. Yd. Concrete Per Hour	Average Production: Lin.-Ft. Piling Per Hour	Average Production: Man-Hr. Per Cu. Yd.	Average Production: Man-Hr. Per Lin.-Ft.	Average Per Cent Efficiency: Mining	Average Per Cent Efficiency: Labor	Labor Cost Per Lin.-Ft.
Total Piles	8	319.0	18.19	14.17	135.27	.....	135.27	0.77	22.57	4.25	0.424	22.3	26.8	$0.093
1	45	1404.0	79.99	24.00	184.89	.....	184.89	3.33	58.00	2.32	0.1316	58.0	49.0	0.058
2	26	832.0	48.48	16.67	133.52	.....	133.52	2.80	50.00	2.76	0.1605	49.5	41.3	0.061
3	31	1085.0	59.60	21.41	154.39	.....	154.39	2.87	50.07	2.59	0.1422	50.1	43.9	0.054
4	30	1038.0	55.46	13.89	145.29	.....	145.29	4.00	75.00	2.62	0.1399	74.2	43.5	0.061
5	52	1508.0	81.27	19.09	200.25	13.19	213.44	4.26	79.00	2.62	0.1415	78.1	43.5	0.049
8	40	1264.0	69.36	16.72	148.34	17.05	165.39	4.15	75.49	2.39	0.1308	74.5	47.6	0.048
Total	232	7450.0	412.35	125.95	1101.95	30.24	1132.19	3.28	59.01	2.75	0.1519	58.4	41.4	0.060

TABLE II—PRODUCTION ANALYSIS OF PILEDRIVING OPERATIONS

Bridge Number	No. of Piles Driven	Total Lin.-Ft. Piling Driven	Total Hr. Used in Driving Operations	Total Man-Hours Needed	Average Time of Operations in Hours: Moving Bent to Bent	Moving Pile to Pile	Setting Pile in Leads	Driving Pile	Total Operation Per Pile	Average Man-Hr. Per Pile	Average Per Cent Efficiency: Driving	Average Per Cent Efficiency: Labor
Test Piling	7	284	5.25	46.00	....	....	....	....	0.67	6.57	32.0	21.4
1	45	1404	67.99	339.95	2.17	0.79	.....	0.46	1.78	7.55	19.7	18.5
2	26	832	36.83	184.15	....	....	....	....	1.42	7.08	15.7	19.8
3	31	1085	37.77	188.85	.....	1.06	.....	0.60	1.30	6.09	21.5	23.0
5	52	1508	33.43	167.15	2.85	0.11	0.21	0.22	0.60	3.21	46.7	43.6
8	40	1264	36.12	198.66	3.61	0.25	0.30	0.17*	0.90	4.96	31.2	28.2
Total	224	7131	212.14	1124.76	2.97	0.43	0.25	0.31	0.95	5.04	29.4	27.8

*All piles driven in pilot holes.

TABLE III—PRODUCTION ANALYSIS OF CONCRETE MIXING AND PLACING

Bridge No.	Cu. Yd. Concrete Placed	Actual Mixing Time	Man-Hours Used: Net Mixing Hours	Man-Hours Used: Lost Minor Delays	Man-Hours Used: Total Man-Hr. Used	Average Production: Cu. Yd. Concrete Per Hour	Average Production: Man-Hr. Per Cu. Yd.	Average Per Cent Efficiency: Mixing	Average Per Cent Efficiency: Labor	Labor Cost Per Cu. Yd.
1	330.57	48.73	794.28	71.09	865.37	6.90	2.63	69	46	$0.95
2	169.68	28.26	520.66	.....	520.66	6.00	3.07	61	40	0.91
3	208.31	33.57	404.52	22.46	426.98	6.21	1.94	63	63	0.89
5	404.54	82.41	1237.60	85.02	1322.22	4.87*	3.30	50	37	1.04
6	160.77	22.00	397.50	96.00	493.50	7.31*	2.47	75	50	1.06
7	398.81	67.00	1517.46	119.33	1636.79	5.96*	4.10	61	50	1.54
8	284.74	41.54	615.59	80.85	696.44	6.86	2.46	70	50	0.88
Total	1957.42	323.50	5487.60	378.75	5866.35	6.05	2.80	62	44	1.04

* Average for 21-S mixer, using 4-sack batch.

various foremen, kept the time and payroll records, ordered the materials and ran errands. Job superintendent No. 1 was in charge of all bridges except No. 5, which was at the extreme north end of the project. This superintendent, in addition to the above duties, took active charge of the concrete crew for about half of the placing time. Job superintendent No. 2 handled Bridge 5, exclusively.

The forces were divided into two concreting crews: two piledriving crews, and two form crews with one extra crew for pile casting during the latter part of the work. The working time was limited to 30 hours a week for each man exclusive of the foreman, and it was necessary to maintain two shifts of both skilled and unskilled labor for continuous performance.

All skilled and unskilled labor was furnished by the National Re-employment Service, which required the use of local labor where available. This labor was available but was of very poor quality, and the turnover was high, reaching 35 per cent in one month. Most of this turnover was voluntary, as many of the men supplied did not care for the kind of work offered and failed to report back.

The production and cost records reflect the lack of qualified labor, for it was often necessary for the contractor to maintain a larger crew than ordinarily would be required, to be sure that enough men would be left near the end of the day to finish the work at hand. The minimum rates per hour were 35c. for unskilled and 45c. for skilled labor.

The foremen were for the most part hired by the district superintendent and were interchanged between the various bridges as required. No definite delegation of authority was attempted, and lack of cooperation between the foremen and job superintendents was evident throughout the job. Requests for equipment and orders for supplies were neglected and ignored by the district superintendent on the grounds of expediency and economy, with resulting delays.

Manner of keeping records

The records from which the accompanying tabulations have been made were taken from the daily reports of the inspectors, who recorded the time of starting and stopping each pay operation, the amount and nature of the delays, the actual number of each class of labor employed for each operation and the daily amount of work completed during the time period. Only the work requiring the continuous presence of an inspector was timed, as it was not practicable on this project to maintain an inspector with each outfit during the periods of excavating, erecting falsework and forming.

At the start of the job only the morning starting time and the evening stopping time were recorded as a matter of routine for the construction diary, but after the contractor began to complain of the lack of progress and attempted to charge this against the inspectors, a more detailed system of timing was developed. Lack of experience in such work delayed the development of the final plan of timing operations until a part of the job was well under way, but as finally worked out the results give a fairly complete picture of the time used in the actual income-producing operations on the pay items of the contract completed before the writer was transferred to another project.

Pile-casting operations

Table I covers the concrete pile-casting operations for the entire project. The actual mixing time is the period from the time that the first wheelbarrow was dumped into the skip until the last of the concrete was dumped into the forms. The net man-hours are the actual number of man-hours for the entire crew during the time the mixer was operating. The man-hours lost on minor delays cover the hours in which the crew was on the job and idle due to breakdowns or delays in the delivery of materials. The total man-hours used represent the sum of the above man-hour items or the total number of hours, including the delays, that were required to fill the forms multiplied by the number of men in the crew.

The average efficiency was secured by using the best daily average production as 100 per cent and computing the ratio between it and the daily average for the entire bridge. The labor efficiency represents the ratio between the least number of man-hours required per cubic yard of concrete and the average per cubic yard for the entire bridge. The labor cost per linear-foot is the actual amount expended for direct labor during the mixing and placing period only, and does not include form setting, placing the mixer or any other items.

Two mixers were used in the pile-casting operations, a 10-S being used on all but Bridge 5, where the 21-S was put into service after the 10-S brought to the job failed to operate. Not much variation is noted in the rate of production of the two different-size mixers; and since the ground condition at all bridges was practically the same, the variation that does appear is traceable to lack of proper management control, for the labor crew remained practically the same for all bridges and only the foremen were changed. The same foreman handled the crew at Bridges 1, 2 and 3, but each of the other structures was in charge of a different foreman for each operation.

Table IV shows that the equipment was on the job for a total of 75 calendar days, of which only 111.78 hours was required for the mixing and placing of the concrete for the piling. These hours were distributed over 42 days. The rest of the 53 available days was used in setting forms or was lost in delays. On the first three bridges, the foreman was provided with five pile forms and allowed a theoretical production of five piles per day, while on the last three bridges the forms were increased to ten and the theoretical production was increased with apparent economic results.

Piledriving studies

Table II is the summary of the daily reports on the piledriving operations. On the test piles and on Bridge 2 no detailed time study was made, but on Bridges 1 and 3 the operations were divided into two parts, moving and driving. The moving cycle was timed from the stopping of the hammer on one pile until it was set on the next pile ready to drive, and the driving cycle covered the actual driving of the pile.

Starting on Bridge 5 and continuing for the rest of the work, four separate cycles were used: first, moving from bent to bent, which was timed from the stopping of the hammer on the last pile in the bent until the driver was in position over the first stake in the next bent; second, moving from pile to pile, which covered the same cycle without the distance move from bent to bent; third, setting the pile in the leads, which covered the interval from the time the driver was in position until the hammer was set on the pile and the order was given to start driving; and fourth, the actual driving time as before.

TABLE IV—ANALYSIS OF TIME USED ON ALL OPERATIONS

Bridge No.	No. Piles	Total Length, Ft.	Concrete Cu. Yd.	Calendar Days Mixer on Job	Days Lost	Available Days	Days Machine Used	Mixer Hours Used	Per Cent Available Time Used
Casting Piling									
1	45	1404	79.99	15	4	11	9	24.00	21.8
2	26	832	48.48	9	2	7	7	16.67	23.8
3	31	1085	59.60	13	1	12	9	21.41	17.9
4	30	1038	55.46	5	1	4	4	13.89	27.85
5	52	1508	81.27	14	4	10	7	19.09	19.09
8	40	1264	69.36	19	10	9	6	16.72	18.6
Total	224	7131	394.16	75	22	53	42	111.78	21.09
Driving Piles									
1	45	1404	.....	33	11	22	16	67.99	30.9
2	26	832	.....	13	6	7	6	36.83	52.6
3	31	1085	.....	21	7	14	12	37.77	29.0
5	52	1508	.....	20	8	12	12	33.43	27.8
8	40	1264	.....	19	3	16	10	36.12	22.57
Total	224	7131	.....	106	35	71	56	212.14	29.87
Placing Concrete									
1	...	....	330.57	58	15	43	14	48.73	11.3
2	...	....	169.68	31	12	19	7	28.25	14.9
3	...	....	208.31	17	4	13	7	33.57	25.8
5	...	....	404.54	55	15	40	17	82.41	20.6
6	...	....	160.77	12	1	11	4	22.00	20.00
7	...	....	398.81	78	23	55	11	67.00	12.2
8	...	....	315.17	16	2	14	8	41.54	29.7
Totals	...	....	1987.85	267	72	195	68	323.50	16.58

The higher average man-hours per pile and the slower time of total operations on Bridge 1 are the result of trying to use a jet and drive the piles into a pack sand that would not respond to the water jet. Such attempts to use a jet in a material that does not respond are usually costly, and the resulting alignment of the piling is generally unsatisfactory.

The use of pilot holes such as were used on Bridge 8 is much more satisfactory than the jet in hard material. These holes are drilled with a bit that will make a hole equal to the largest diameter of the pile, and are carried down through the impenetrable stratum or far enough into it to secure the required penetration of the pile with a few blows of the hammer after it has been dropped into the hole. Normally, if the material is dry and hard enough to interfere with driving, it will stand without casing the hole; with such holes the actual driving time has been reduced from 35 to 50 per cent. In many cases it is possible to mud the sides of the hole with a mud pump as the drilling progresses, in the same manner that is used in the drilling of oil wells, and thus avoid the necessity of using casing in unstable material. These holes usually fill without further attention and apparently allow the piling to function as designed.

The record of the piledriving operations is not particularly impressive, with an average of four pilings a day for the entire project. On this project three piledriving foremen were employed by the contractor. The first man completed half of the test piledriving, all of Bridge 2 and all but two bents of Bridge 1 before being discharged for failure to cooperate with the job superintendent. The second foreman completed the driving at Bridge 1 and all of Bridge 3 before being released on account of carelessness and inability to handle men. The third foreman, who directed the driving on Bridges 5 and 8, was well qualified and produced the best records and results secured on the job.

The moving and setting time on Bridge 5 was the best secured on any of the bridges in spite of the fact that the ground conditions at Bridge 8, the last bridge driven, were much more favorable for these operations. The most probable explanation of this improved time is the foreman's bonus of $1 per pile for each pile driven above an average of five per day, including both concrete and timber piles. The bonus was not allowed on any of the bridges except 5.

From Table IV it is noted that the drivers were on the job 106 days and were actually used on 56 of these days for a total of 212.14 hours for the driving of the concrete piling. Mechanical breakdowns account for 8.98 per cent of the available time that was used, and the rest was consumed in driving the timber piling for form support and in management losses.

Concrete production

The records of the placing of the structural concrete as summarized in Table III were secured and analyzed in the same manner as those for the concrete pile-casting operations in Table I.

For placing the caps and superstructure, the 10-S concrete mixers were used on Bridges 1, 2, 3 and 8, and the 21-S mixer was used on Bridges 5, 6 and 7. The concrete was all handled in the two wheel buggies or carts when being placed in the forms. On Bridges 2 and 6 these carts were run up a steep runway from the mixer to the top of the forms, which required the full effort of three men to each cart. At Bridges 5 and 8 the mixer was placed at the level of the bridge floor, and an approximately level runway was built along the entire length of the bridge outside the forms for the use of the carts. A tower elevator and hopper in combination with the carts was used on the remaining structures 1, 3 and 7.

Table IV shows that there were 195 available machine days for concrete production, of which 68 were actually used. On these days, 323.50 hours, or 16.58 per cent of the total available time, were used. The remaining time was taken up by form building or management losses.

No record was kept of the exact time used in the construction and setting up of the forms, but an analysis of the available days consumed in the bridge construction shows that 5.6 days per span were required on Bridge 1 for both forms and concrete; 4.75 days per span on Bridge 2; 3.8 days per span on Bridge 3; four days per span on Bridge 5; and two days per span on Bridge 8. If the time required on Bridge 8 can be taken as normal, then all of the 28½-ft. span bridges could have been completed with the same crew in 68 days instead of the 129 days actually required for both forms and concrete.

If the maximum rate of concrete production secured had been maintained throughout the entire project, all of the concrete could have been placed in 202 hours, or approximately 62 per cent of the time actually used. The maximum rate of production was not attained for any of the mixers on the project at any time, and if it had been reached or even approximated the saving in time and labor cost would have been considerably more than one-third.

Summary

In summarizing all of the operations on these structures it is found that the contractor had a total of 3,190 available machine hours during which the machines actually performed income-producing work on 166 days for a total of 647.42 hours, or 20.2 per cent of the total available time. This appears to be a rather small percentage for the work involved, and it would seem that continued studies should be able to evolve a definite ratio between the time required for productive and non-productive operations.

Groundwater in the Midwest Drought Area

An interpretation of the influence of geological formations on the groundwater resources of the north-interior states and an appraisal of the effect of the drought on these water supplies

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IT IS DIFFICULT to define, either in time or space, the great drought from which we hope we are emerging. This difficulty is due chiefly to the capricious variability of the weather and the local character of many of the rain storms. The records, however, will show that within the period of record it is outstanding with respect to duration, areal extent and intensity. Never before in the weather history of the United States has there been such a deficiency in precipitation over so wide a territory throughout an entire growing season, according to J. B. Kincer of the Weather Bureau. The situation has been even more seriously aggravated, Mr. Kincer points out, by the extremely high temperatures accompanying the lack of rain. Nothing remotely approaching the severity of this combination appears in the annals of the Weather Bureau.

The drought has manifested itself, not only in the semi-arid region but also over wide areas that are normally humid and have long been regarded as areas of demonstrated agricultural quality, by the ruin of crops, the drying up of grasslands, the killing of trees, the scorching effects produced by the hot winds, the pall of dust clouds and the failure of water supplies.

Of all the manifestations of this drought the most weirdly impressive was that of the dust storms of last winter and spring, some of which were almost nation-wide in their extent. Considering their magnitude and intensity, these storms were apparently unique in the human history of this country. It is not altogether a comforting thought to recall that in the geologic history of the country, dust storms have been of common occurrence, as indicated by the great mantle of wind-blown silt that covers a large part of the interior of the country. It is interesting to note that while we are chiefly concerned with the damage done by the wind erosion in the recent dust storms, these ancient silt deposits, which geologists call loess, are largely responsible for the productivity of the great farming region between the Appalachians and Rockies.

The purpose of the present paper is to outline briefly the water-supply conditions and problems in the north-interior region, as affected by the drought, with special reference to the geology of the region. It will be shown that, next to the weather itself, the geologic conditions are the most important controls of these water supplies in times of drought.

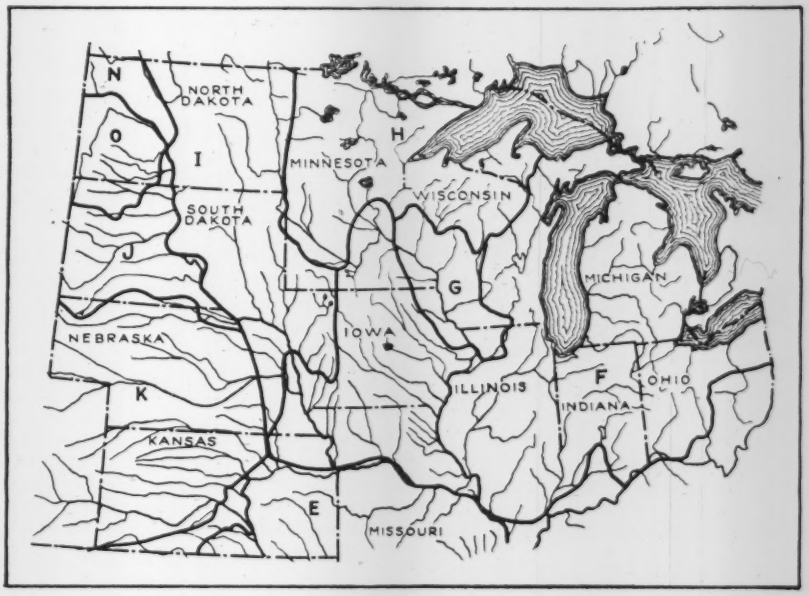


FIG. 1—NORTH-INTERIOR REGION showing groundwater provinces. In E and G the principal water-bearing formations are paleozoic sandstones and limestones. In F, the paleozoic rocks are overlain by glacial drift, containing beds of water-bearing sand and gravel. In H, glacial drift rests on granite or other crystalline rocks that yield only meager supplies of water. In I, glacial drift overlies cretaceous formations, which include the water-bearing Dakota sandstone. In N, glacial drift overlies tertiary and cretaceous formations that contain water-bearing sandstone. In J, principal water-bearing formation is the Dakota sandstone. In O and K, cretaceous rocks are overlain by tertiary and associated pleistocene formations that contain productive beds of water-bearing sandstone, sand and gravel.

Much of the north-interior region is underlain by water-bearing formations that constitute great natural hold-over reservoirs, the principal water-bearing rocks being cavernous limestones, porous sandstones and deposits of sand and gravel. These great underground reservoirs have not been seriously depleted by the drought, and in the extensive areas underlain by such reservoirs, containing water of good quality, the water-supply problems have not become critical, although in the aggregate many supplies from surface or shallow sources have failed or become inadequate. The critical areas are those in which the recognized water-bearing formations are absent, filled with salty water, or locally too thin or impermeable to be satisfactory sources.

The natural underground reservoirs are similar in some respects to artificial surface reservoirs. Generally, they have very large storage capacity, and their supplies are replenished from time to time by rain and melting snow. Except in arid regions, they generally overflow through springs and seepage areas and furnish the principal flow of the streams between periods of precipitation. However, the trees and other vegetation make heavy drafts on this water, especially in the valleys where the groundwater table is near the surface. In some of the arid valleys in the western part of the country all of the discharge is accomplished by the vegetation, and practically no water appears at the surface.

In times of drought the following sequence of events occurs: There is little or no replenishment of the underground supplies. Hence, with continuing discharge, the groundwater levels decline and, concurrently, the discharge from the underground reservoirs lessens and the flow of the streams diminishes. If the water-bearing formation is a thick deposit of permeable sand or gravel, or a thick cavernous limestone, the streams are likely to continue to flow throughout the drought, although considerable shrinkage may be expected. If, however, the only water-bearing formation is a clayey, surficial material with little permeability or storage capacity, the vegetation may consume all the water

that would otherwise be discharged through the springs and may even lower the groundwater table a considerable distance below the bottoms of the stream channels.

These processes, thus elementally stated, were as clearly displayed in the drought region as in an open textbook, and they furnish the key to the water-supply problems created by the drought and, in large measure, indicate the solution of these problems.

The north-interior region (specifically the area shown in Fig. 1) contains four major groups of water-bearing formations: (1) the paleozoic sandstones and limestones; (2) the cretaceous sandstones; (3) the tertiary and related pleistocene deposits of sand and gravel; and (4) the sand and gravel deposits of the glacial drift.

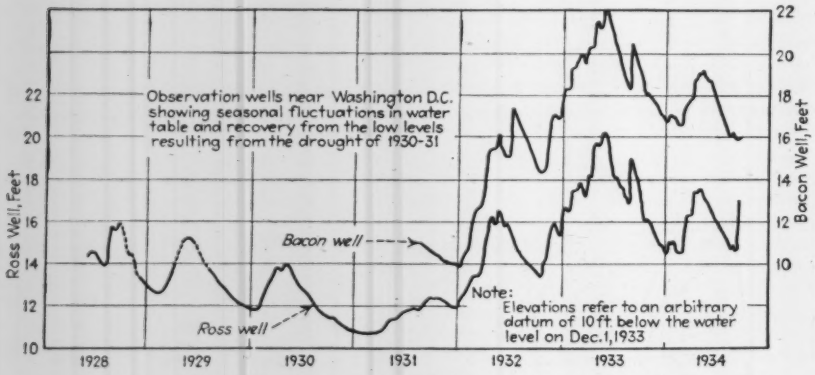

Observation wells near Washington D.C. showing seasonal fluctuations in water table and recovery from the low levels resulting from the drought of 1930-31
Ross Well, Feet
Bacon Well, Feet
Bacon well
Ross well
Note:
Elevations refer to an arbitrary datum of 10 ft. below the water level on Dec. 1, 1933
1928
1929
1930
1931
1932
1933
1934

FIG. 2—HYDROGRAPHS of two wells near Washington, D. C., indicating seasonal fluctuation in level and the marked recovery from the low levels caused by the drought of 1930-'31.

The paleozoic rocks include the St. Peter sandstone and the thick beds of Cambrian sandstone, also a number of limestones of Ordovician, Silurian, Devonian, and Mississippian age, which in their cavernous phases are excellent reservoirs of water. These formations yield supplies to drilled wells in the province designated G on the map, in an extensive area in Wisconsin, Illinois, Minnesota and Iowa, in parts of Indiana and Ohio, and in a large area centering in the Ozark uplift, chiefly in Missouri.

In these areas the wells, as a rule, have not been seriously affected by the drought; and where sandstone or cavernous limestone is at the surface, the streams have continued to have relatively well-sustained flow. The paleozoic rocks extend under other parts of the region shown on the map, where, however, their waters are highly mineralized and mostly unfit for use.

In eastern Kansas, the southeastern corner of Nebraska, northwestern Missouri and southwestern Iowa, in addition to parts of the states farther east, the rocks that lie at the surface or immediately below the glacial drift are of Pennsylvania or Permian age. These uppermost paleozoic rocks consist largely of shale with some interbedded sandstones that contain highly mineralized water. The glacial drift where it occurs in this area is also relatively unproductive. Therefore, the wells in this region are generally shallow and weak, the most reliable groundwater supplies being obtained from the alluvium of the principal valleys.

Many of the towns have built reservoirs to impound surface water, while on many of the farms the domestic supplies are obtained from rainwater stored in cisterns and the livestock supplied from storm runoff impounded by small earth dams. In this area the wells failed in large numbers except in the principal valleys, and the streams dwindled greatly or dried up completely. The supplies of a large proportion of the cisterns and farm reservoirs became exhausted. Further, many of the municipal reservoir supplies became seriously depleted, and a few were virtually exhausted. In July, water was being hauled in trucks and tank cars from Kansas City and other cities on the Missouri River to supply many farms and some towns. In many localities farmers were hauling water from old wells that were still yielding supplies or from new wells sunk by the emergency relief agencies, generally in the valleys. These conditions extended southwestward through Oklahoma and Arkansas into Texas. Pennsylvanian rocks also underlie the glacial drift or occur at the surface in large parts of Illinois, southwestern Indiana and southeastern Ohio, where they are largely unsatisfactory for water supplies.

Cretaceous formations

Formations of cretaceous age underlie the western part of the region shown on the map (most of provinces I, N, O, J and K). They consist chiefly of dense and impermeable shale but include minor amounts of sandstone and limestone and, in the lower part, include strata of sandstone that are loosely called the Dakota sandstone. This sandstone is well known because of the great artesian pressure under which its water originally occurred. It furnishes the water supply for thousands of farms and many municipalities in North and South Dakota and, to a less extent, farms and municipalities in several other states. In most of the wells the water still rises to the surface under small pressure. The wells supplied by the Dakota sandstone were essentially unaffected by the drought and furnished secure supplies in some of the most severely stricken areas. Unfortunately, the water is too highly mineralized to be entirely satisfactory for domestic use, but the problems of improving the quality, or in some cases of developing more acceptable supplies from other sources, are not related to the drought.

In most of the plains section of western South Dakota (see map, Province J) cretaceous shale is at the surface. The streams heading in the shale area carry little except storm runoff, and the shallow-dug wells in the surficial shaley material are weak and unreliable. The area is underlain by the Dakota sandstone, which is reached only by deep wells, and in some the water stands far below the surface. Therefore, there are relatively few Dakota sandstone wells, and reliance is placed largely in small surface reservoirs for livestock supplies. It is perhaps needless to say that the supplies of both the shallow wells and the small reservoirs failed to a large extent as the drought progressed, and the principal unfailing supplies have been furnished by the few deep wells.

The Dakota sandstone underlies most of the western part of Kansas, but its water is here largely too salty for use. In some places in the eastern part of this state, the cretaceous shale is at the surface and produces unfavorable conditions similar to those in the paleozoic area in the eastern part of Kansas. Last July some of these shale localities were almost entirely dependent on the supplies in the alluvium of the valleys, which were being depleted by pumping and by the demand of the trees. Where the Dakota sandstone outcrops along the Missouri River, it yields potable water and thus forms a belt of favorable water-supply conditions between the unfavorable areas of shale.

Tertiary deposits

In most parts of the Great Plains (see maps, Provinces N, O and K) the older rocks are covered by tertiary and associated pleistocene deposits that contain beds of sand and gravel that yield abundant supplies of good water. In these parts of the Great Plains both municipal and farm supplies are generally obtained from drilled wells, which as a rule were not seriously affected by the drought. Last July, in an inspection of the area through South Dakota, Nebraska and Kansas, striking contrasts were observed between the distressed shale areas and the favorable areas underlain by tertiary or pleistocene water-

bearing beds, both as to wells and streams. For example, the Republican River along a stretch in south-central Nebraska forms the approximate southern boundary of an extensive pleistocene formation of sand and gravel. South of the Republican is the area of cretaceous shale that has just been described. Last July, in the area to the south, the wells had generally weakened or failed, and many farmers were hauling water, whereas in the northern area the wells were everywhere yielding water from the sand and gravel formations, and there were no indications of depleted supplies. Likewise, the southern tributaries of this section of the Republican River were all dry, whereas the northern tributaries were spring-fed streams, some with considerable flow.

Glacial drift deposits

The glacial drift, which covers the older rocks in the greater part of the north-interior region (see map, Provinces F, H, I and N), includes large quantities of sand and gravel, irregularly interbedded with the boulder clay washed out from the morainal fronts. These glacial deposits form the principal source of water supply in the region. They are of major importance in Michigan, Ohio, Indiana, Wisconsin, Illinois, Minnesota, Iowa, North Dakota and the eastern parts of South Dakota and Nebraska. On account of the irregular distribution of the glacial sand and gravel, it is difficult to generalize as to the effect of the drought upon the water supplies from this source. The large and thick bodies of water-bearing material, as a rule, have not been seriously depleted by the drought, but in many localities where the drift is thin or unproductive the wells have weakened or failed. Attention has already been called to the inadequacy of the drift in southern Iowa, northern Missouri and adjacent parts of Kansas and Nebraska.

In the greater part of Minnesota, northern Wisconsin and the western part of the Upper Peninsula of Michigan the glacial drift rests directly on granite or other crystalline rocks that are unproductive or only meagerly productive of water. In the parts of this area where the drift is thin or wanting in good water-bearing beds, the water-supply situation is generally difficult. First-hand information is not at hand to show the effects of the drought in this region, but it is reported that in some areas, especially in western Minnesota, the water-supply problems have become acute. The conditions are also difficult in parts of the Red River Valley in Minnesota and North Dakota, where there is a lack of potable groundwater and the surface supplies are seriously depleted.

The drought has emphasized the value of the groundwaters. It has also demonstrated the value of the systematic studies of the occurrence, quantity and quality of these waters, carried on for many years by the federal and state geological surveys. Without the basic information derived from these studies it would have been impossible to meet the emergency as effectively as was done. On the other hand, the drought has shown impressively that much more intensive and quantitative investigation is needed to put our knowledge of water supplies on a more secure and satisfactory basis. Much more work needs to be done to locate accurately the existing water-bearing beds, to determine their storage capacity, hydrologic behavior and safe yield.

A much more systematic and comprehensive program should be developed and maintained for obtaining records of pumpage or artesian flow from the different water-bearing beds and continuous records or periodic measurements of the water levels or pressure head in carefully selected observation wells—both water-table wells and artesian wells, in areas of heavy withdrawals and in areas where essentially natural conditions still exist. Intensive studies should be made on groundwater replenishment, and the results of timberland clearing, bringing prairie areas under cultivation and other changes made by man on replenishment. A study should be made of the effects that would result from proposed changes in agriculture, and the practicability of increasing the groundwater supplies by any of the proposed methods of artificial recharge.

Wherever groundwater supplies are insufficient and unreliable in times of drought, steps should be taken to build reservoirs in the towns and on the farms that can reasonably be expected to furnish adequate supplies during drought periods. Investigation will doubtless show that some of the larger municipalities drawing on productive water-bearing beds are approaching the safe yield of these beds. In such places comprehensive plans should be made for developing new supplies from surface or underground sources before an emergency is created by the decrease of supply and the increase of demand produced by drought.

More detailed studies should be made of the mineral contents of the water in each of the successive water-bearing beds that may occur in the same locality, in order that only the best water may be recovered and the water of higher mineralization may be cased out. More systematic study should also be given to the possibilities of improving the quality of the groundwater, especially by softening and removal of iron, and to the development of properly treated surface-water supplies where the groundwater cannot be made acceptable by treatment. In some of the municipalities where a highly mineralized deep-well supply is replaced by a more acceptable supply derived from surface water or shallower groundwater, the deep wells should be kept in serviceable condition, to furnish reserve supplies if needed in times of drought.

Groundwater levels

It is widely believed that the groundwater levels have permanently declined in the north-interior region, and this belief has led to the fear that, in the future, there will be further progressive decline with ultimate disastrous results. The U. S. Geological Survey is at present making periodic measurements of the water levels in about 3,000 observation wells and is maintaining automatic water-stage recorders on 115 of these wells in different parts of the country. The comparatively small number of wells for which long-term records have been obtained are in areas of intensive groundwater development.

These records show the drawdown that has resulted from heavy pumping for municipal, industrial or irrigation use in these areas and are therefore of great practical value to the communities concerned. They do not, however, throw light on the question of the long-term trend of the water table outside the areas of intensive development. The observation wells outside these areas generally have records of less than ten years; which is too short a period to determine long-term trends.

The records show conclusively that the water table undergoes pronounced fluctuations from season to season and from year to year with changing weather conditions, as is illustrated by the hydrographs of two of the observation wells near Washington, D. C. (Fig. 2). These records furnish evidence from which the following important inferences may be deduced: (1) Even before the white men came into the country the groundwater levels were fluctuating, and hence the concept of an original groundwater level is essentially fictitious; (2) the present low groundwater levels in the north-interior region are largely due to the severe drought conditions of the last few years; and (3) there will be recovery of the groundwater levels with recurring wet years.

The extensive land-drainage developments have been made largely for the purpose of lowering groundwater levels, and they have doubtless had that effect in the areas treated. Moreover, it is quite possible that the net result of bringing both timber and prairieland under cultivation has been to depress the average position of the water table. However, the streamflow records and investigations of transpiration show that in recent years, as well as in earlier years, the underground reservoirs have discharged great quantities of water by overflowing through springs and by supplying the needs of the trees and other vegetation in low places.

It appears, therefore, that there is no reason to fear that there will be progressive lowering of the water table in the future, with disastrous results, ex-

cept in areas of excessive pumping. The U. S. Geological Survey, in cooperation with the U. S. Soil Erosion Service and several state geological surveys or other state organizations, is at present greatly strengthening its program of measurements of water levels in observation wells. If this program is adequately developed and maintained, it should be possible to ascertain at any time in the future the exact stage of the water table.

Mixed-in-Place Road Surfaces with Controlled Aggregate

Screened and washed gravel and crushed-stone macadam aggregates, bitumen-penetrated and mixed-in-place, are providing serviceable highways at low cost in Vermont

ROAD-MIX MACADAM Vermont main road approaching completion. Truck is spreading cover for seal coat.

A DESIGNED aggregate mixture, penetrated with tar or asphalt and mixed on the road, preferably with multi-blade graders, is being employed with excellent service results on an increasing mileage of Vermont highways. The construction is being used both on state-system and state-aid roads and is the same in principle for both, but a greater range in quality of aggregates is permitted on town roads and the surfacing is thinner. Depending on the aggregate, whether gravel or broken stone, on length of haul and on general construction conditions, main-road surfacing is costing in round figures $4,000 to $6,000 a mile. Town roads are costing about $1,000 less a mile, and under special conditions both classes of surfaces will run considerably under the costs named.

To date, more than 275 miles of mixed-in-place roads have been constructed in the last three yaers. Practice has been constantly improved as experience was obtained and at present is developed to a perfection that assures very effective control of results. Primarily, improvement over the first roads constructed in 1931 has been in foundation and drainage, but more careful surfacing methods and control of materials are also practiced. As now built, the roads have good durability and riding qualities and are costing only a little over $400 a mile to maintain.

General construction principles

The first requirement for success laid down by the state highway engineers for mixed-in-place surfacing is a stable foundation. Slight flexural strength is attributed to the bituminized wearing surface only 2 to 2½ in. thick—the base is considered the strength element in design. On this theory, base design is not standardized; local material is relied upon, and this is generally pit-run gravel selected with consideration of its compacting properties and laid to such depth as the subgrade conditions require. Rolling and shaping the base course is exacted as essential to a smooth and stable bituminous wearing course.

The roadway is designed to the engineering standards of its class. For state-system roads, the standards of width and drainage are those for rigid pavement, the mixed-in-place surfacing being a step in stage construction to the higher-type pavement when that is justified by traffic. In primary essentials a permanent road grade is sought for mixed-in-place surfacing. On this is placed a capable load-carrying base finished to correct profile, compacted and primed with tar or asphalt. This priming is held to be important in holding the base material in place, preventing intrusion into the surface mix of undesired base materials and as a seal in some measure against the rise of capillary moisture into the surface course.

This surfacing in Vermont practice is in no degree a hit-or-miss mixture. Local material is used to the utmost extent, but it is a selected and prepared material. Generally the aggregate is gravel, but crushed stone is also used. Considering gravel primarily, pit material is selected that shows the most hard and durable stone (if possible, one giving a percentage of wear not exceeding 16) that is locally available and is within reasonably economic hauling distance. But hardness limits are not made exacting, and the best gravel that can be got is made to serve, for local pits must be used if the cost of the road is to be kept down. Good roads have been built from banks having a mixture of hard and soft stone and from banks of stone uniformly softer than 16 per cent wear.

While percentages of wear are left subject to judgment, screening and washing are insisted upon for all aggregate. Only the portion above sand size (⅜ in.) is used for the body mix, the sand being used only for filler after the gravel mix is rolled and has the final seal.

Also about 40 per cent of the gravel is required to be crushed to increase bonding and compaction under the roller. A clean gravel enables more uniform distribution of the bituminous binder, and therefore the lean mix is used that is desirable to resist shoving and reduce soft spots. Similarly, a clean coarse sand, virtually pea gravel, gives the most stable filler and seal. In effect, the design of mix is pointed to producing a surface in which the coarse aggregate is exposed and takes the wear, and the sand and tar act as a filler and binder.

Material requirements

As stated, two types of mixed-in-place surfacing are employed—one a gravel and tar mixture and one a crushed stone with a cutback asphalt binder. To prevent confusion, the materials for each type will be described separately.

Gravel Construction—For gravel construction three grades of aggregate are specified. Sand for filler and for use with seal gravel is required to be washed and have a fineness modulus not less than 3.20; not more than 3 per cent is to pass a 100-mesh screen, and all is to pass a ⅜-in. screen. Gravel for seal is to pass a ¾-in. screen and be retained on a ⅜-in. screen. Gravel for the mix is to pass 1¼-in. and be retained on ⅜-in.,

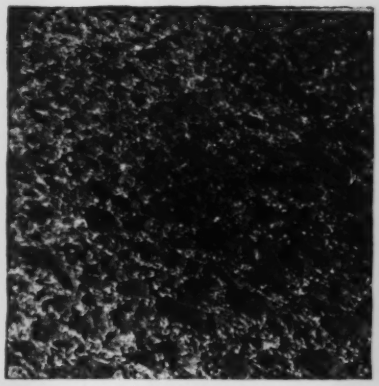
both screens having circular holes. A tolerance of 5 per cent is allowed in all of these sizes, but uniform gradation in each size is required. In the gravel for mix, 25 to 40 per cent is required to pass ¾-in. The tar for priming the base is to be of 25 to 40 viscosity, and that for the mix of 35 to 65 viscosity and both are to possess such binding qualities that after 24 hours they will "cause the mixture to remain stable under traffic."

Stone Construction—A stone having not more than 5 per cent wear is required. Stone for the mix is to pass 2½-in. and be retained on ¾-in., and from 30 to 75 per cent is to pass 1½-in. For seal and cover, the stone is to pass ¾-in. and be retained on ¼-in. In both grades a tolerance in size of 5 per cent is allowed. A cutback asphalt (Asphalt Institute R. C. 3) is used for the mix.

Construction methods for gravel

Careful construction of the gravel base is required; even spreading, thorough rolling and shaping to exact profile are required. Soft spots and humps are eliminated as they are disclosed by the rolling. When shaped to final cross-section, the base is treated with priming tar (25 to 35 viscosity) at the rate of 0.33 gal. a square yard. Half the road is treated at a time, the other half being open to traffic; after priming each half, the road is closed until the tar has penetrated and set firmly enough not to pick up under traffic. Soft spots developed by traffic are filled with a gravel-tar mix, and every part of the base surface is restored to true plane before any surfacing is applied.

The surfacing gravel is distributed evenly to the full width of the road surfacing (generally 18 ft.). A dry base is required before distribution, and a dry surfacing gravel before tar is applied. The first application is 0.5 gal. (35 to 65 viscosity) a square yard. The first mixing follows, with preferably a multi-blade drag or retread mixer set to cut to the base prime coat. Mixing continues until the gravel is uniformly coated, after which it is graded smooth and given the second application of 0.3 to 0.4 gal. of tar per square yard. Mixing is continued as before, and the surfacing is again spread even and then rolled.



SURFACE TEXTURE of Vermont road-mix macadam cleaned for application of seal coat.

The rolling is carefully performed. A ten-ton three-wheel roller is used, working from each side to the center overlapping half the tire width of one rear wheel on each trip. At each side the rolling is started 6 in. from the edge, and the edge strips are not rolled until at least three days after the mixing is completed. This delay gives the tar time to stabilize and reduces the tendency of the edges to break down and feather out under the roller. Another detail that is carefully watched is the jointing of successive sections of surfacing to prevent an overdose of tar at the joint. The practice is to cut back the mixed course to give a full-depth square joint across the road, and back from this joint to spread building paper far enough to keep any spray from the tar distributor from reaching the already tarred surfacing.

Rolling is continued until the surfacing is stable under the roller; after the surfacing has then been in place three to six days, the sand filler (enough to fill all surface voids) is spread and broom-dragged. Sealing is postponed if practicable to the end of the work When undertaken, the road surface is swept clean of all loose material, leaving a mosaic surface that is entirely clean. It is then tested with a 10-ft. straight-edge, and any variation exceeding ½ in. is eliminated. A 40-viscosity tar is applied at the rate of 0.25 gal. a square yard and covered with a mixture of one part sand and two parts seal gravel smoothed by a broom drag. If plenty of pea gravel is available, the sand is omitted. The blotted surface is then rolled, and the surfacing stands completed.

Construction methods for stone

When stone is used for the surface mix, the general construction procedure is about the same as for gravel, but some of the details are changed. After the

PRESSURE DISTRIBUTORS apply tar or asphalt for mixed-in-place macadam roads in Vermont.

MULTIPLE-BLADE GRADERS are preferred equipment for mixed-in-place macadam surfacing on Vermont highways.

gravel base is compacted and shaped, the shoulders are lined up to hold the surfacing stone in place. One half of the road is primed and closed to traffic until the prime coat has penetrated and is stabilized; then the second half is closed and primed. The priming application is 0.33 gal. of cutback asphalt at 140 deg. F. Unless traffic is detoured, the surfacing stone is spread on one-half of the road at a time, and on the second half only just before applying the asphalt so as to reduce traffic on the untreated stone.

Three applications of asphalt are made. The first is 0.1 gal. a square yard and is mixed with the stone as in gravel construction. The mixed surface is then spread, 0.5 to 0.75 gal. per square yard is applied, and the mixing process is repeated. After spreading, the mix is rolled enough to shape the surface and embed the stone. Enough keystone to fill the surface voids is then spread, and the surface is rolled thoroughly. Keystone is again spread and dragged into the surface voids. After straightedging and correcting the surface, 0.5 gal. of asphalt is applied and covered with keystone, and the road is rolled.

An equipment process

In carrying out the construction processes described, equipment is used wherever possible. Well-outfitted washing, screening and crushing plants are set up to prepare the surfacing gravel. Trucks are loaded from overhead bins or by cranes, and spreader boxes are used to spread the material on the grade. Pressure distributors, blade graders, multiple-blade maintainers, broom drags and spreaders are used for surfacing operations on the grade, and modern type rollers are used for compacting base and surface. In general, the Vermont-type mixed-in-place main road is strictly machine-constructed. Structurally it ranks more nearly with the bituminous macadam and bituminous concretes than with the usual road-mix surfaces of pit run or crusher-run materials. As developed under H. E. Sargent, commissioner and chief engineer, and the engineers of the Vermont department of highways, the mixed-in-place road ranks high among bituminous road types.

Redwood Logs Used for Fills on California Highway

Clearing and earth moving reduced on coastal highway through redwood forest by using corded logs for fills

LOGS would not ordinarily be a cheap substitute for earth in highway fills, but on a new section of the Redwood Highway through heavily forested areas in northern California log fills have shown a saving in cost with attendant advantages in preserving scenic beauty. On this road redwood logs cleared from the right-of-way were used for fills in Del Norte County, and saved $33,000 by reducing excavation, embankment, drainage and clearing. Incidentally, redwood logs are particularly suited to this use because they decay slowly and the thick bark is highly resistant to fire so that they do not burn readily.

Preservation of scenic beauty was an important factor in planning this work through heavy timber growth, where many of the trees are more than 150 ft. high with diameters of more than 5 ft. at the stump. Also the cost of disposal of trees cut on the right-of-way was an important item, particularly because it is very difficult to burn redwood logs. Using the logs in fills had then the following advantages:

1. It provided means for disposal of logs in the immediate vicinity of cutting and reduced the cost of logging and hauling involved in disposal.

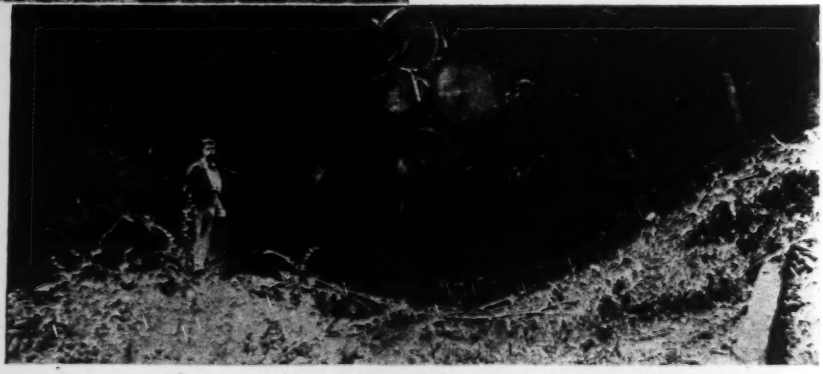
2. A slope of 1 on ¼ was practicable in the log fills, thus reducing the area of clearing in comparison with a normal embankment slope of 1 on 1½, and also avoiding removal and disposal of this much additional timber and small growth.

3. Use of log fills reduced the embankment yardage to be made up from excavated material, permitted less depths of cuts and decreased slide probabilities besides saving in clearing on the excavated slope.

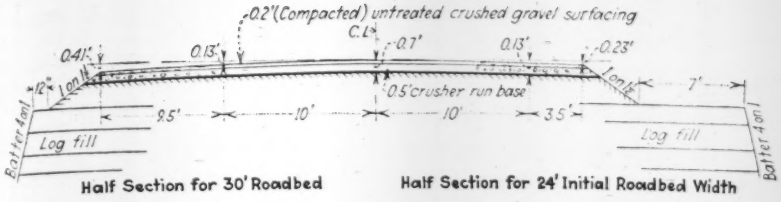
4. Embankment scars of bare earth slopes were kept to a minimum, and the side view of the fills, which show the butt ends of the logs, could be given a rustic appearance.

Construction methods

The logs usually were cut in 20-ft. lengths; those with diameters exceeding 4 ft. were split, and none less than 2 ft. in diameter were used except in packing. The logs were placed across the road, with the larger ends on the downhill side to make the layers or courses as nearly level as possible. The courses did not exceed 5 ft. in depth.



PLACING LOGS in the toe of a roadway fill on the Redwood Highway (left) and face of a log fill (right), showing close cording of timber.



TYPICAL CROSS-SECTION of roadway over log fill on forest road in northern California.

and the exposed ends of succeeding courses were so placed that the slope of the finished face would be 1 on ¼. A longitudinal log was placed at the toe of the fill, well embedded in a trench, to assist in leveling the base course, which was, nevertheless, required to have a full bearing on firm ground.

For getting the logs in place the contractor used a high-line cable fastened to trees and extending over the fill center line. Logs were lifted free of the ground at one end by a line from a carriage on the overhead cable and were maneuvered into the desired position in the fill with the aid of a crew skilled in woods operations.

Each fill was planned so that it would utilize the quantity of redwood logs available and would finish off not less than 4¾ ft. below and parallel to the roadbed grade. Care was taken to reduce the voids in the log fill to a minimum, and the top surface, formed of split logs, was sealed by chinking with split pieces of sound redwood to make a tight deck between the body of the log fill and the earth material placed thereon. Where log fills were used in depressions that ordinarily would require a drainage opening not more than 18 in. in diameter, drainage pipes were omitted if the logs extended entirely through the embankment; otherwise, pipes were embedded with at least 1 ft. of earth blanket around them.

To expedite recovery of a natural appearance of the roadway after construction, earth excavation slopes were left rough and rock excavation slopes were provided with pockets and roughened areas in which could be placed selected topsoil for plant growth. Also, embankment slopes were covered with selected top soil that was stripped and stockpiled in advance of grading operations so that it would be available for this use. Desirable plants and shrubs that otherwise would be destroyed were transplanted or stockpiled before construction began and later were set out on the finished slopes.

Climatic conditions are such that it is improbable, in the opinion of engineers in charge, that these timber fills ever will become entirely dry. Hence the fire risk is very low. A peculiarity of redwood is that the logs begin to send out shoots soon after they are felled. In some cases, at least, it is expected that sprouts already starting from logs in the fills will produce trees.

The contract for the work was held by the Youdall Construction Co. and Charles Harlowe, Jr. The work was carried on under the direction of the state division of highways, of which J. W. Vickrey is district engineer and H. C. Amesbury resident engineer in this district.

San Francisco Garbage Disposal Continues With Fill-and-Cover on Tide-Flat Areas

GARBAGE DISPOSAL in San Francisco is still carried on by the fill-and-cover method, which has been used for the past two years pending settlement of prolonged debate on disposal methods. A less expensive transportation plan that would employ barges on the bay and a new site for disposal are under consideration; the situation at present is summarized in the following.

Collection is by private scavenger companies under rates fixed by referendum ordinance and under supervision of the department of public health. About 100 collection routes in San Francisco are served by 90 trucks and 30 horse-drawn wagons. (Wet garbage from hotels and restaurants is purchased and removed by hog raisers as an entirely separate undertaking.) The trucks have capacities of 18 cu.yd., and the wagons 11 cu.yd. Collections vary from daily to a minimum of weekly; the collectors are required to take garden trimmings, broken furniture and all discarded material from residences. Two years ago total daily collections in San Francisco exceeded 650 tons and reached 700 tons on peak days. Showing the effect of the depression on the garbage can, the average daily collections now are about 550 tons.

Scavengers deliver garbage to a central station in the railroad yards, where the vehicles drive up a ramp and dump by gravity into gondola cars. Loaded cars are thoroughly hosed down to lessen dust and flying papers and to aid in compacting garbage after delivery to the fill. Loading into the gondolas continues from about 7:30 a.m. to 4 p.m. During the night, cars containing the previous day's collection are switched onto the dump sidings. Unloading is by clamshell bucket mounted on crawlers delivering to horse-drawn dump trucks that haul the garbage to the edge of the embankment.

The garbage is deposited in layers not exceeding 7 ft. in depth and is then rolled and covered with 2 ft. of dry earth over which the 12-ton roller is operated to give further compacting. Each day's delivery is completely covered and sealed by 4.30 p.m. of the same day. There is a direct shrinkage in the fill of about 2 ft. in the first 24 hours, and then a gradual settlement until the 7 ft. of garbage and 2 ft. of earth are compacted to 6 ft., which occurs in a period of about six months. Further settlement is minor in character.

Difficulties from this plan arise if any departure from specifications is permitted. Dangers are a large rodent population and noxious gases from cracks in improperly covered fills. Constant rigid inspection and enforcement of specifications have made the plan entirely satisfactory, according to city officials. Industrial land is being made at the rate of about 1½ acres per month. The fill is on tide flats owned by the railroad company and adjacent to the railroad's main line out of San Francisco along the peninsula.

The cost for the collection and disposal of garbage, including ramp and cost at the central station, approximates $1 per ton. This includes overhead, railroad freight at 23c. per ton and $23 a day for the privilege of dumping in San Mateo County. The present program, so far as the methods and place of disposal are concerned, is regarded as temporary in nature, and city officials hope that a new and more permanent arrangement can be effected soon.

Many Sewerage Improvements Approved by PWA

Sewerage and sewage-disposal projects numbering 648 had been approved for allotments by the PWA on Aug. 1, 1934, according to a recent announcement by that organization. The total cost of these projects will aggregate $212,476,188, of which $184,728,767 was allotted by the PWA. The rest was raised by the localities involved. The projects range in size from the reconstruction of the sewage-treatment plant at Eureka Springs, Ark., for which PWA allotted $12,000, to the Chicago sewage-treatment plant project, for which $42,131,040 has been allotted.

From Job and Office

Lowering a Water Tank by Flame-Cutting the Tower Leg

By R. H. Patterson
Consulting Engineer, White Sulphur Springs, Inc.

IN CONNECTION with the medical baths at The Greenbrier Hotel at White Sulphur Springs, W. Va., there was erected some years ago a 50,000-gal. flat-bottom, wood water tank on a steel tower 60 ft. high. At the time this tank was built it was probably not considered important enough to attempt to conceal it among the trees covering the promontory on which the tank stands. Laterly, however, more attention has been given to the esthetics of the surroundings, and last summer it was decided to lower the tank 20 ft. This would remove it from view without seriously lessening the water pressure.

GAS-CUTTING TORCH, used to reduce the length of the double-angle legs of a water tower, is an ingenious procedure which lowered the tank 20 ft.

Instead of dismantling the tank, cutting down the tower from the top and re-erecting the tank on a new platform, it was decided to experiment a little. Tank and tower were securely guyed, and the anchor bolts were loosened from the bedplates so as to allow free movement of the structure on its foundations. One at a time each leg of the tower was jacked up, the anchor bolts cut off and the bedplates removed. An oxy-acetylene cutting torch was applied, and one-half of each leg, composed of two angles, was burned off at a height of 4 ft. The half-legs were in turn cut vertically, one after another in the manner shown in the accompanying figure until the leg was reduced to a thin point about 12 in. long. After this the resultant points of metal were burned off 4 in. at a time, each leg in turn, so that the height of the whole structure was reduced 4 in. by each cut thus made around its four legs.

This process was repeated with constant tightening of the guys until the tank had been lowered a total of 20-ft. The tank was now completely concealed in the trees and an objectionable eyesore removed from the landscape.

The bedplates were replaced, new anchor bolts set, the old footplates were cut off the original bottom sections and welded to the new sections, the tower bolted down, piping reconnected and the job was finished.

The change was accomplished with the aid of two mechanics and two laborers.

Anchorbolt Assembly Placed Without Use of Templet

IN PLACING anchorbolts in the forms for the concrete foundations of Boulder Dam power house, a plan is being used whereby the complete assembly of the bolts is set at one time, and the exact alignment prescribed is thus obtained without the necessity for locating each of the bolts separately by means of a templet.

The exact spacing and the relative position of the anchorage as a whole are fixed by welding angles to the bolts in a preliminary shop-assembly operation. Thus the complete assembly can be lifted into the forms by the derrick, and only a single operation of leveling and aligning the entire group is required. Any portion of the steel angles used in the bracing which would interfere with later functioning of the assembly is unbolted or cut away with a torch. It is expected that this method will save time in erection without any sacrifice of the necessarily high degree of accuracy.

TWO ASSEMBLED GROUPS of 3½-in. anchor bolts ready to be lifted into Boulder Dam power-house foundation forms.

Strain-Gage Location and Value of *E* in Compression

By I. F. Morrison and R. M. Hardy
University of Alberta, Edmonton, Alberta, Canada

IT IS WELL KNOWN that the distribution of compression stress on the ends of a compression test piece, such as a concrete cylinder or short wooden block, is not uniformly distributed. In general, however, little attention seems to have been paid to the necessary distance of a plane cross-section from the end of the specimen at which the state of a uniform stress distribution can be considered as nearly existent and to the effect of the departure in fact from this assumed uniformity on the modulus of elasticity of the material as determined by the usual strain-gage methods.

There are primarily three contributing phenomena, each of which tends to produce a departure from the desired uniformity of load distribution. The consequences of a non-uniform contact are obvious, and many expedients are adopted to overcome this defect, not always with complete success.

Second, due to the prevention of the lateral expansion that tends to accompany direct compressive strain, there is induced a radially directed frictional force on the contact surface of the specimen. In spite of the use of lubricants, thin layers of soft rubber and similar devices, the effect of this frictional force is to destroy the uniformity of compressive-load distribution.

But even if the uniformity of contact were perfect and all end-surface friction were eliminated, still there would not be a uniformity of stress distribution. The reason for this third phenomenon lies in the fact that the lateral dimensions of the test specimen are often quite different from those of the compression blocks, and, as the lines of stress pass from the end of the specimen into the block, they diverge into the larger cross-sectional area. This tends again to destroy the uniformity.

The only apparent way to eliminate these complications to an otherwise very simple procedure is to avoid taking strain measurements too close to the ends of the specimen, for, by St. Venant's principle, there is a tendency for the stress distribution on the plane cross-section to become more and more uniform for points more remote from the ends.

In an attempt to demonstrate this

principle the authors had prepared two circular cylinders of mild steel, of excellent quality and in the hot worked condition. The carbon content was roughly 0.2 per cent, and there was no evidence of internal stresses. These cylinders were about 1.9 in. in diameter and 4 and 7 in. in length respectively. Special attention was paid to the ends, to insure good contact with the compressive block. The strain measurements were carefully taken for a 2-in. gage length at the center of each specimen, with an electric contact extensometer reading directly to 1/10,000 in. Oil was used on the ends to facilitate seating the specimen and to aid in reducing the contact friction.

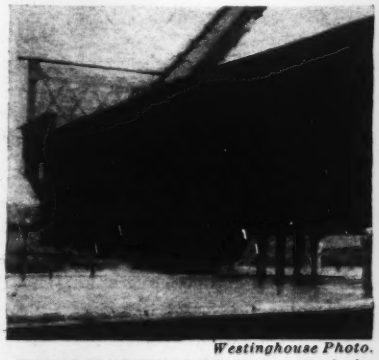
It is to be noted that the gage points for the two cases came respectively 1 and 2½ in. from the ends. The moduli of elasticity were determined in the usual way by plotting the stress-strain curve. They were 25.3 x 10^6 and 29.5 x 10^6 lb. per sq.in. respectively for the short and long cylinders. This is a surprisingly large difference, and the low value for the short cylinder can be attributed only to the non-uniformity of the stress near the ends of the specimen.

From this it would appear that, for the compression test, the strain-gage points should have contact with the test piece not closer to the end than the diameter of the piece. The authors feel that the effect set forth above tends to cast some doubt on the numerous determinations of the modulus of elasticity for compression of materials reported from various sources and especially those made on concrete cylinders. Such results are likely to be too low.

Photo-Electric Cell Lines up Swing Bridge

By O. R. Elwell
Bridge Engineer, Washington State Highway Dpt., Olympia, Wash.

TO TELL when the 300-ft. swing span over the North Willapa River at Raymond, Wash., on the new Coast Highway is exactly lined up on closing, a photo-electric cell is placed on the end of the span and a light source on one of the piers. When the beam from the light source strikes the photo-electric cell, a green light appears on the control bench and a circuit is completed so that the end wedges can be driven. Regardless of weather conditions, even in fog or a heavy rain, the operator thus knows when his bridge is exactly lined up.



Westinghouse Photo.

PHOTO-ELECTRIC CELL shown on end of swing span of Washington State highway bridge.

Continuous Bent-Bar Unit Used to Replace Stirrups

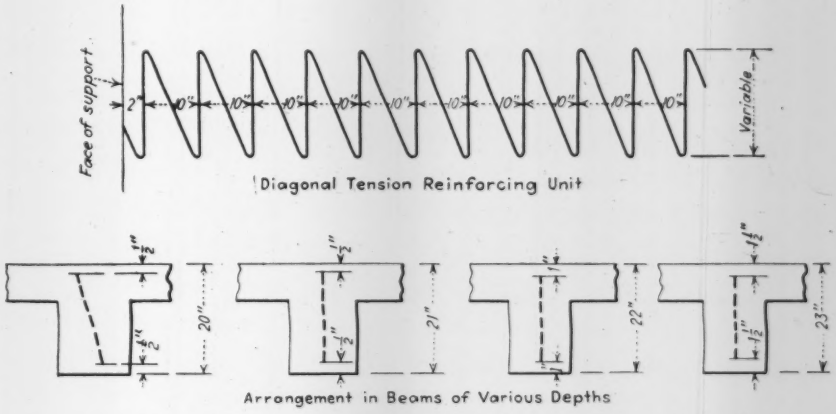
By William Flesher
Birmingham, Ala.

IT IS common knowledge that a variety of solutions as to stirrup spacings in concrete beams and joists can be obtained by different engineers solving the same problem. But even worse than the vast assortment of methods for determining stirrup spacings is the laxity in the field in placing the stirrups. Loose stirrups as effective and accurate diagonal tension reinforcement are, in brief, nothing more than a hope, a guess and a remote probability.

The writer has used (where he has been able to get it approved by the designing engineer and the city building department authorities) a type of diagonal tension reinforcement that seems to constitute an improvement. This *DTR* unit, as it may be called, is a continuous strip bent as shown in the accompanying diagram. If this unit were more extensively used, fabricators could standardize and stock it, since its only variable is that of depth. The diagram also shows one depth of *DTR* unit can be used satisfactorily in four different depth beams. Since the depth of concrete beams ranges in general from 16 to 28 in. and of concrete joists from 8 to 14 in., ¼-in. rods may be used for units in beams under 20 in. deep and ⅜-in. rods for units in beams over 20 in. deep. Thus the number of units to be stocked can be kept down to five or less, which will be usable in 90 per cent of the beams and joists. The other 10 per cent would have to be custom-made, the same as loose stirrups. The 10-in. spacing of the vertical legs is standard for all types and sizes and should be acceptable from the designer's and fabricator's point of view.

Where more reinforcement is found to be necessary than is provided by a single 10-in. spaced unit, it is more economical to use additional units than to use closer spacing. Also, to vary the spacing would introduce the same difficulty met in designing loose stirrups. The sketch shows a total length of 6 ft. 8 in. which is the writer's idea of a convenient length.

Being continuous, the *DTR* unit develops the maximum in bond. It is also positive in arrangement. Another advantage lies in the ease with which steel-tonnage estimates can be made. And finally the placing of the unit is unusually simple. In practice it is installed after the main reinforcement is in place. A few transverse bars placed and held at the proper elevation provide an ideal support from which to hang the units.

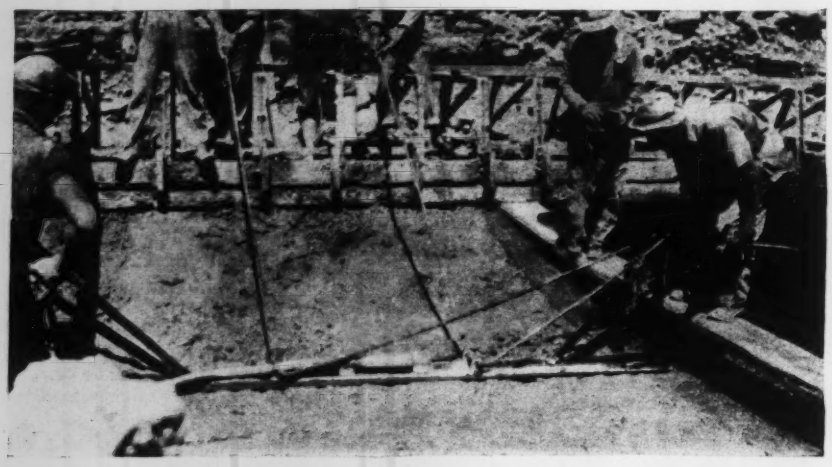


CONTINUOUS UNITS of diagonal tension reinforcing to take the place of stirrups. The lower sketch shows how a unit 20 in. deep may be used in beams of four different depths by varying its position and the cover.

Tunnel Invert Smoothed by Vibrated Screed

IN CONSTRUCTING the Fan-Hill concrete siphon on the aqueduct that is to bring water from the Colorado River to Los Angeles, Calif., careful oiling of the forms and thorough vibration of the concrete in the walls and arches gave the desired finish to the upper part of the conduit, but the invert presented quite a different problem because it was finished by hand, no surface forms being used.

To meet this condition, a four-man screed was built on which was mounted on of the electric vibrators used in the wall and arch forms. This screed con-



VIBRATED SCREED finishing invert of concrete siphon on Los Angeles aqueduct

sisted of a 6-in. steel channel 10 ft. long with plow handles at each end; the vibrator was bolted to the center of the channel, and wires supplying it with current were brought out over the plow handles at one end. Fastened also near the center of the channel were manila ropes that extended at right angles to the channel in both directions. Each of these ropes was manned by an operator, so that as the men at the plow handles gave the screed a sliding motion back and forth, the ropes were used to skid the screed laterally up the slope of the invert parallel to the center line of the aqueduct, work on each section beginning at the center or bottom of the invert and proceeding upward toward the wall, first on one side and then on the other. Transverse board templets embedded in the concrete at 8-ft. intervals served as guides and rests upon which the device was guided as it was traversed back and forth.

The screed was developed by Mr. Hjalmarson, superintendent for the Metropolitan Water District at Fan-Hill siphon.

Moment of Inertia of Spirally Reinforced-Concrete Columns

By E. T. Jensen

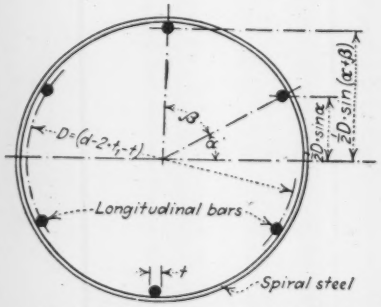
Research Assistant, Iowa Engineering Experiment Station, Iowa State College, Ames, Iowa

WHEN occasion demands the computation of the moment of inertia of a spirally reinforced-concrete column, the common practice is to resort to a close approximation. This approximation assumes the longitudinal steel to be in the form of a cylindrical shell of equivalent cross-sectional area and a diameter equal to that of the spiral. This method, while surprisingly accurate, involves some very long and tedious computation, requiring the determination of the difference between the fourth powers of two slightly different diameters. This can only be accomplished with the aid of a mechanical calculator and is entirely out of the question for slide-rule work.

The writer has developed a method based on an accurate analytical solution of the general problem which readily lends itself to slide-rule computation. The most complicated step of the whole solution is the determination of the significant value of the second power of one term.

The general expression for the moment of inertia of a spirally reinforced-concrete column may be written as:

$$I = I_c + (n-1)\,I_s \quad \ldots\ldots\ldots\ldots\ldots (1)$$



CROSS-SECTION of a spirally reinforced-concrete column.

The term I_c is a comparatively simple one so that the problem dwells almost entirely with the solution of I_s. The following nomenclature is used:

- d = outside diameter of spiral.
- t_1 = diameter of spiral wire.
- t = diameter of longitudinal bars.
- D = nominal diameter.
- m = number of longitudinal bars.
- β = central angle between longitudinal bars.
- α = central angle for minimum moment of inertia.
- I = moment of inertia of total section.
- I_c = moment of inertia of concrete.
- I_s = moment of inertia of steel
- n = ratio of moduli of elasticity of materials.
- A_c = concrete area.
- A_s = total steel area.

By summing the moments of inertia of the individual steel sections shown in the accompanying sketch about the neutral axis of the entire section it is possible to write the following expression,

$$I_s = \left[\frac{m.\pi}{64}\right].t^4 + \frac{\pi}{16}.D^2.t^2 \left\{\sin^2\alpha + \sin^2[\alpha+\beta] + \sin^2[\alpha+2.\beta] \ldots + \sin^2[\alpha+(m-1)\,\beta]\right\} \ldots (2)$$

Applying the fundamental theorem of maxima and minima to this expression, a minimum value of I_s may be found. The value $\left(\frac{2\pi}{m}\right)$ is substituted for β. Differentiating Eq. (2) with respect to α and equating the first derivative to zero gives the result that α must always be zero regardless of the number of bars. Eq. (2) may now be written

$$I_s = \left[\frac{m.\pi}{64}\right].t^4 + \frac{\pi}{16}.D^2.t^2 \left[\sin^2\left(\frac{2.\pi}{m}\right) + \sin^2\left(\frac{4.\pi}{m}\right) + \sin^2\left(\frac{6.\pi}{m}\right) \ldots + \sin^2(m-1)\left(\frac{2.\pi}{m}\right)\right] \quad (3)$$

A close study of the long coefficient (in brackets) of the second term in Eq. (3) reveals that it is simply an arithmetic series whose sum may be written as $\left(\frac{m}{2}\right)$. Combining this with the other factor $\left(\frac{\pi}{16}\right)$, the complete coefficient of the second term is $\left(\frac{m.\pi}{32}\right)$. Eq. (3) for the moment of inertia of the circularly placed steel may be rewritten in the following simple form for round bars:

$$I_s = \left(\frac{\pi.m}{64}\right).t^2\,[t^2 + 2.D^2] \ldots\ldots\ldots (4)$$

The equation for the moment of inertia of the composite section, using round bars, may now be written:

$$I = \frac{\pi}{64}.d^4 + (n-1)\left(\frac{\pi.m.t^2}{64}\right)[t^2 + 2.D^2] \quad (5)$$

with d the diameter of the concrete core.

When square bars are used, there is a slight change in coefficients, and the thickness of the bars, b, replaces the diameter:

$$I_s = \left(\frac{m.b^2}{4}\right)\left[\frac{b^2}{3} + \frac{D^2}{4}\right] \ldots\ldots (6)$$

The equation for the moment of inertia of the composite section, using square bars, is:

$$I = \frac{\pi}{64}.d^4 + (n-1)\left(\frac{m.b^2}{4}\right)\left[\frac{b^2}{3} + \frac{D^2}{4}\right] \quad (7)$$

European Experts Diagnose U.S. Housing Ills

Meeting of National Association of Housing Officials is occasion for brief reports on impressions of nationwide tour of slums

THE EUROPEAN housing experts who have been visiting this country under the auspices of the Spelman Fund have completed their tour of fourteen cities, and their report, applying their views on housing to conditions in the United States, will be published before the end of the month. It was analyzed and discussed at a round-table meeting between the European visitors and American housing officials in Baltimore Oct. 16-19 and was followed by a meeting of the National Association of Housing Officials in Washington Oct. 20, at which Sir Raymond Unwin and Miss Alice J. Samuel, the British authorities, and Dr. Ernst Kahn, the German expert, offered suggestions and advice.

Sir Raymond urged broader understanding by federal, state and local housing officials, built upon recognition by the local authorities that they cannot see the problem as a whole and by the federal authorities that they can never hope to gain an intimate knowledge of local conditions. Adoption of rigid standards may save trouble for central officials, but such standards cannot be satisfactorily or mercifully applied, said Sir Raymond, unless adjusted to suit local conditions.

The housing problem is complicated because it is not simply a question of the house but of the peculiar human animal who lives in it. He described housing as an art based not only upon scientific knowledge but on the human touch that appeals to the emotions. Sir Raymond predicted that, if he could judge by the signs, America is going into a great housing movement that will produce results not tomorrow, nor the year after but over a long term of ten or twenty years.

Slum-clearance projects now under way were frankly criticized by Miss Samuel as failing to make adequate provision for rehousing the families that lived in the old structures. Inquiry made in many places, said Miss Samuel, brought the recurrent explanation that only a small proportion would be able to afford the new accommodations. "You are making a scheme of clearing land rather than a scheme of rehousing. If you assume that these people will disappear into a kind of fog, that means they will go into houses already occupied and breed new slums."

Miss Samuel advocated new projects on the outskirts of towns for housing families able to afford the necessary rental, thus encouraging a voluntary movement from the slums to the houses so evacuated.

The forthcoming report by the European experts will be submitted to President Roosevelt; Alfred K. Stern, vice-president of the association and chairman of the Illinois Housing Board, expressed the hope that it will become the basis of a new deal for housing, with the support financial and otherwise that has been given to other New Deal activities. Henry Wright, the American architect who accompanied the European visitors on their tour, asserted that there is only one solution of the housing problem and that lies in an appreciation of its magnitude. "Until we see it as something to do on a tremendous scale, we'll scarcely do it on any scale," he declared. "Our object must be to prevent slums. I'm impressed after this trip with the fact that we are making a mess far greater than we are trying to clean up. I saw evidences of new slums being created by emergency measures."

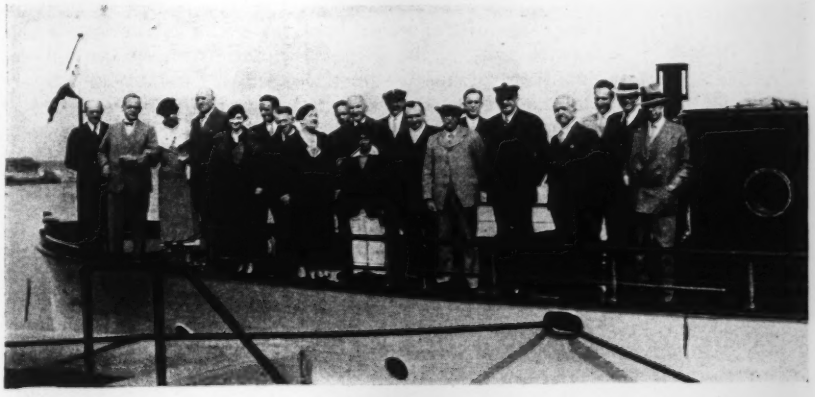
Limited-dividend housing

Diverse views on the utility of the limited-dividend corporation were expressed by Horace W. Peaslee, of the PWA Housing Division, and Miles Colean, director of the technical division of FHA. Mr. Peaslee said that half of the Housing Division's time since its organization was lost in the development of limited-dividend projects which proved impossible of realization. Although half a dozen projects have gone forward, the percentage of practicability is so small as to make it futile.

Mr. Colean expressed the belief that there is a real place for the limited-dividend corporation under the National Housing Act. He explained that FHA does not propose to confine low-cost housing to projects in which it is combined with slum clearance. In other respects, FHA's policy also may be more liberal than PWA's as, for example, in limiting the return on investment only for the duration of the loan. Asked whether this would not permit speculative abuses later, Colean expressed the opinion that this policy would result in better low-cost housing than if undertaken commercially in the first instance.

A report by Coleman Woodbury, director of the association organized nine months ago, revealed the pace with which the housing movement is growing. Fifteen states have enacted limited-dividend laws. Ten states have enacted laws creating a housing authority or providing for the establishment of local authorities. Fourteen cities have set up local authorities. More than 200 housing officials have taken office in less than a year. The association's membership numbers 125.

Ernest J. Bohn, president, of Cleveland, and Alfred K. Stern, vice-president, of Chicago, were re-elected by a unanimous vote. Horatio B. Hackett, director of the PWA Housing Division, was elected to the executive committee for a three-year term; Miles Colean, FHA technical director for two years, and Langdon Post, chairman of the New York Municipal Housing Authority for one year.



HOUSING EXPERTS IN CHICAGO ON THEIR TOUR OF THE COUNTRY. Left to right: F. J. C. Dresser, PWA Housing Division, Chicago; Dr. Ernst Kahn, Frankfort, Germany; Miss Elizabeth Wood, executive director, Chicago Metropolitan Housing Council; Alderman John A. Massen; Miss Irene Williams; Alfred K. Stern, chairman, Illinois State Housing Board; Henry Wright, architect, New York City; Miss A. J. Samuel, manager Bebington Housing Dept., Liverpool, England; G. E. Ryan, PWA Housing Division, Chicago; Carroll H. Sudler, district director, FHA, Chicago; Alfred R. Stern, Jr.; Arthur Bohnen, Chicago Metropolitan Housing Council; Ernest Bohn, president, National Association of Housing Officials; Sir Raymond Unwin, member, National Housing Committee for British Isles, London; Russell G. Creviston, Crane Co.; J. B. Berryman, president, Crane Co., and host to the party; H. W. Seymour, Crane Co.; Louis Sudler, Chicago; W. W. De Berard, western editor, *Engineering News-Record;* and Edgar S. Nethercut, Western Society of Engineers.

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October 18, 1934

M. M. O'Shaughnessy

PECULIARLY TRAGIC is the passing of M. M. O'Shaughnessy sixteen days before the date set for the first water to flow into San Francisco through the 155-mile Hetch Hetchy Aqueduct system. As city engineer of San Francisco from 1912 to 1932 and as consulting engineer to the Public Utilities Commission since that date, Mr. O'Shaughnessy was the motivating and directing power in the great task of carrying out the twenty-year construction operation required to insure an adequate water supply to San Francisco. His drive for such a supply in the early days when there was much opposition to the Hetch Hetchy project served in no small way to draw attention to the urgency and complexity of the water-supply situation in California, a state that now is foremost among the states in handling water matters. Mr. O'Shaughnessy's twenty years of work as head of the engineering department of San Francisco has overshadowed but in no way detracts from the importance of his earlier work at San Diego and in Hawaii. Always colorful and energetic, Mr. O'Shaughnessy for nearly fifty years has been a picturesque figure in engineering on the Pacific Coast, a man whose opinions, even though they sometimes were not agreed to by his fellows, universally were respected.

Groundwater and the Drought

INTEREST in the groundwater resources throughout the north and central states was intensified by the drought of last summer. Shrinking streams and failing shallow wells focused attention on those vast underground reservoirs, similar to surface storage in the fundamental characteristics of annual inflow, capacity and drawdown, but only little understood or appreciated without intensive investigations, particularly in the field of geology. Next to climate, geology is the most important factor influencing groundwater supplies. Water-supply engineers will find valuable information in the review of the basic geology of the north-interior states as presented in an article in this issue. It is reassuring that the conclusions indicate that the drought did not materially deplete the important groundwater resources of that region.

New But Not Hazardous

IT IS A PRIME TENET of mortgage-lending practice always to look with doubt upon innovations in building construction and, in general, to discourage them. Unfortunate as this attitude is, it is accepted as necessary for safe lending, and the Federal Housing Administration, in laying plans for inaugurating its mortgage-insurance program, has felt obligated to subscribe to it. Insuring mortgages amortized over a period so long that it approaches the useful life of the property, according to FHA, calls for a conservative policy regarding types of construction that have yet to prove that they do not affect the marketability of the propery. One ray of hope is held out to ingenuity and enterprise, however. A special division is being set up to watch new technical developments. Lending agencies have been watching the parade go by for so long without joining it that the functioning of this branch of FHA will be a matter of much interest. If it can immediately junk the erroneous idea that innovations in architectural form are one and the same with improvements in technical details so far as loan value is concerned, it will contribute handsomely to progress in building. It would be stimulating and helpful if mortgage lenders would take some chances on new architectural forms; but if the gamble is deemed too great and they must be conservative, they should not be blind as well. Everything that is new is not hazardous.

One for the Books

THE LITTLE PLEASANTRIES of political correspondence and badinage that are so faithfully reported by the newspapers these days are often unexpectedly enlightening. To wit: Mr. James A. Farley, erstwhile state political chairman in New York, wrote Mr. Robert Moses, head of the Long Island State Park Commission, "I must confess that I don't agree with your method of selecting men, which you indicate is done by a board of engineers." Replied Mr. Moses: "There is absolutely no politics in the running of the Long Island region. . . . I personally never interfere with the paid executives who must be responsible for getting work done. We have an exceptionally enthusiastic and competent group of young men in the Long Island Commission. They are enormously interested in the program, and at least half of their enthusiasm arises from the fact that they are given authority and responsibility, and are not bothered by politics." Mr. Moses' statement is one for the books. Better still, it might be tacked on the wall.

Based on Opinion

TWO CONSULTING BOARDS have recommended changes in the design of the record-breaking rockfill dam now under construction in the San Gabriel Canyon, to provide a flood-control unit in the Los Angeles County program. Both suggestions include flattening the slopes and modifying of the requirement for fill material, to permit a greater percentage of quarry excavation to be used. Apparently there is agreement that the combination of increase in volume and weight will so offset the possible disadvantage from inclusion of quarry waste as to result in a satisfactory structure. Local conditions and available quarries may have influenced the decision in this particular case; hence it should not be assumed as a general recommendation of basic design of rockfill dams. The interesting point is that the design of this important type of hydraulic structure should remain so largely based on engineering opinion. Although the fundamental concept of a waterproof facing backed by a weight of rockfill is generally accepted, rigorous mathematical confirmation of design or the narrowing of prescribed limits appear difficult. When considered as a subdivision of the general classification of structures built by filling, the rockfill dam is notable for the weight given to engineering opinion unsupported by extensive research. Regardless of the difficulties involved, the subject offers a most fertile field for investigation.

The Activated-Sludge Patent

LAST WEEK our news pages carried an announcement of the fact that the U. S. Supreme Court had refused to review the decision of the Court of Appeals holding that four patents on the activated-sludge process of sewage treatment are valid and have been infringed by the city of Milwaukee. For a number of years this case has been before the federal courts and has been followed with intense interest by the entire sanitary engineering profession, for the question involved deeply affects a large number of cities using or planning to use this process. The action of the Supreme Court has the effect of establishing the validity of four patents on the activated-sludge process, and the case will now be returned to the federal court in Milwaukee for an accounting of damages.

Obviously, the cost to a community of treating sewage by the activated-sludge process will be increased because of royalty charges. Comment on the propriety and justice of this situation would be quite profitless, but it may be entirely worth while to attempt to evaluate the court's action in terms of its probable effects on the development of sanitary improvements.

First, it must be remembered that patents do not have an indefinite life and that the ones under consideration will expire within the next few years. It follows, therefore, that in regard to plants still to be designed this complicating element will be in effect but temporarily.

The primary problem in the design of a sewage-treatment plant is the choice of the process to be employed, a problem that is essentially one of economics. Among these processes capable of giving a high degree of purification can be listed the trickling-filter, the activated-sludge process and the recently revived chemical processes. The cost of plant construction decreases in the order of listing, while the cost of operation increases in that order. The activated-sludge process has become popular primarily because its overall cost, for the desired degree of treatment, has been the lowest. Its acknowledged economic position will be upset by the application of a royalty charge. It is hardly to be supposed that the license fees will be set high enough to throw the economic balance completely in favor of one of the competing processes, but inevitably the added cost will operate to reduce the margin of desirability.

It is with some apprehension, however, that we consider the effect of the decision on the large number of treatment plants now being projected. Public opinion has been but recently induced to favor sewage-treatment improvements as desirable. Through the stimulative efforts of the PWA and state health departments, a host of communities have given approval to the expenditure of public funds for this purpose, and a great number of improvements are planned to use the activated-sludge process. Not infrequently the approval of the public has been given somewhat grudgingly, and in view of the continuing antipathy toward public expenditures it is not unlikely that many communities will at least temper their enthusiasm for rapid execution of the plans. The probability is great that a number will also be strongly disposed to temporize on the sewage-disposal situation, at least until the patents on the most favored process expire.

The fact that must be faced is that the activated-sludge patents have been held valid. Communities already using the process are subject to the payment of license fees to the patent holders. Communities planning to undertake sewage treatment within the next few years will have to take into account this additional cost element in deciding what purification process to employ. In weakening the economic advantage of a popular treatment method, the patent situation weakens the general demand for sanitary improvements on the part of a timorous taxpaying public.

Coordination Needed

ADVERSITY frequently has been characterized as one of our best teachers because it sweeps away the superfluous and strengthens our recognition of what are the essentials to life and human progress. In the matter of water resources—one of the principal necessities of life—this old axiom may find new significance. Two current adverse conditions are serving to demonstrate wherein we have not made adequate provision for current needs or for future planning.

As to current needs, last summer's drought found many towns and cities in the drought area with wholly inadequate water supplies or with supplies so close to the margin of safety as to be a source of continuing concern. Similar drought conditions in other areas doubtless would bring out like conditions. All point to the need for more adequate water supplies.

But this evidence of the inadequacy of our water supplies points also to the need for fuller knowledge and more accurate records of the nation's potential water resources; and here again adversity in a different form has put its finger on a major deficiency in our system of determining what water resources we have. The business depression with its consequent drastic curtailment of many routine government expenditures has resulted in the discontinuance of many stream and rain-gaging stations, thus breaking the continuity of important records.

All too frequently, due to the lack of centralized control over the collection of these records, key stations (in so far as water-resource records are concerned) have been discontinued with the result that we have some areas with more than enough gaging stations—provided their records were coordinated—and other wide areas with none. This is due chiefly to the fact that the operations of the Weather Bureau and the U. S. Geological Survey in collecting data bearing upon water resources have not been properly coordinated.

Coordination of the rainfall and runoff studies of the two principal federal agencies, the Weather Bureau and the U. S. Geological Survey, should be undertaken without further delay, and no further federal studies should be inaugurated without provision for harmonizing them with the existing record-taking work. With the principal federal operations coordinated, the work of extending the coordination to related federal and state operations will be simplified. Due to interdepartmental jealousies such coordination will not be untaken without strong pressure from the top. Here appears to be an opportunity for those who are conducting the President's study for the development of our water resources to make recommendation that will be of immediate value to any future undertakings that they may propose. A clear statement from them of the effect of the present lack of coordination should bring the needed executive order.

CURRENT NEWS

NRA Rules on Assessments Under Construction Code

THE National Industrial Recovery Board issued a ruling on Oct. 11 that a member of the construction industry will pay assessments for code administrative expense to that divisional code authority representing his principal line of business. This ruling resulted from the issue between the general contractors and mason contractors concerning assessments by the Mason Contractors Code Authority on general contractors who perform their own masonry work. However, the decision applies to all divisions of the construction industry unless a division thereof shall have been granted authority by the NRA to assess members of another division in an exemption from the provision of Administrative Order X-36, issued May 26, 1934.

Foreseeing the overlapping and conflicts in collecting code assessments, in particular where manufacturing companies were operating under a multiplicity of codes, Administrative Order X-36 was issued. However, there has never been any rule covering the application of this order to the construction industry, where the operations of general and special contractors are all under one code. No instructions have been issued as to how the "principal line of business" is to be determined.

The complete order follows:

APPLICANTS: Divisional Code Authority for General Contractors, and Code Authority for the Mason Contractors Division of the Construction Industry.

FACTS: Each of the above named divisional code authorities administers a divisional code under the Code of Fair Competition for the Construction Industry. A separate budget and basis of assessment has been approved for each applicant.

QUESTION: Is a general contractor who engages in operations within the definition of the Divisional Code for the Mason Contractors Division of the Construction Industry, but whose principal line of business is within the definition of the Divisional Code for the General Contractors Division of the Construction Industry, exempted by Paragraph III of Administrative Order No. X-36 from contributing to the expense of administration of the Divisional Code for the Mason Contractors Division of the Construction Industry?

INTERPRETATION: The words "code authority" and "code" and "codes" where used in Paragraph III of Administrative Order No. X-36 are to be interpreted as including divisional code authorities, subdivisional code authorities, divisional code, subdivisional code, divisional codes and subdivisional codes respectively.

The question is answered in the affirmative.

NATIONAL INDUSTRIAL RECOVERY BOARD.
By G. A. LYNCH, Administrative Officer.

Mississippi River Dam Contract Awarded to New York Firm

Contract for the construction of Dam No. 6 on the Mississippi River, near Trempealeau, Wis., has been awarded to Spencer, White & Prentis, New York City. The amount of the contract is $1,668,442.

U. S. Supreme Court Declines to Review Power Suits

The Supreme Court of the United States has declined to review two cases brought by private power utilities to prevent the construction of municipally owned power plants. One case was brought by the Arkansas Utilities Co. against the town of Paragould, which proposed to construct a municipal power plant. The other case was brought by the Consumers Power Co. of Allegan, Mich., to stop the issuance of additional bonds by that municipality to finance the construction of a municipal power plant.

Grand Coulee Dam Contractors Complete Organization

Organization of the Mason-Walsh-Atkinson-Kier Co., which has the $29,339,300 contract to build Grand Coulee Dam, has been completed. The board of directors of the new corporation consists of: Silas B. Mason, T. J. Walsh, Guy F. Atkinson, M. J. Whitson, W. A. Hanger, Leo J. Fischer, David Small and W. E. Kier. Officers are: Silas B. Mason, chairman of the board; T. J. Walsh, president; Guy F. Atkinson and M. J. Whitson, vice-presidents; W. A. Hanger, treasurer and E. L. Kier, secretary. H. L. Myer has been named general manager, and Francis Donaldson will be chief engineer.

This contracting organization, assembled for the purpose of bidding the Grand Coulee job, is composed of Silas Mason Co., Inc., New York, Walsh Construction Co., Davenport, Iowa, and Atkinson-Kier Co., San Francisco.

Two 2-yd. shovels have started actual work at the site. Three 5-yd. and two 3-yd. shovels are to be shipped at an early date. Contracts have been let for power requirements and for the construction of a transmission line 13 miles long.

PWA Approves Detroit Slum Clearance Proposal

Detroit is the fifth city (Atlanta, New York, Cleveland and Chicago being the others) in which the Public Works Emergency Housing Corp. will attempt a slum clearance and low cost housing project. Following PWA Administrator Ickes' approval of the proposal of the Detroit Housing Commission last week, Horatio B. Hackett, head of the PWA housing division and two members of his staff went to Detroit to start proceedings in land acquisition. The site, it is stated, will be on the east side of the city, somewhere in the area bounded by Beaubien, Dequindre and Wilkins Sts. and Vernor Highway. Preliminary studies of the project show two and three-story walk-up apartments providing some 4700 rooms. An area of 40 acres and an expenditure of $6,000,000 are two other pertinent figures which have been published.

Consolidation Recommended For Federal Mapping Agencies

Reorganization and consolidation of the several mapping agencies of the federal government will be recommended to President Roosevelt in a report to be submitted by the Science Advisory Board. The mapping committee of the board, under the chairmanship of Douglas Johnson, Columbia University, has worked for several months on a study of the mapping services of the federal government with a view to recommending a greater coordination in operation.

Added incentive for consolidation has resulted from the finding of the Natural Resources Board that its planning studies are affected by the dearth of suitable maps. The board is considering a recommendation to urge an accelerated program to complete the national mapping program.

Water-Rights Suit on North Platte River Authorized by U. S. Supreme Court

THE U. S. Supreme Court has granted the state of Nebraska authority to file suit against the state of Wyoming to determine the rights of the two states to the waters of the North Platte River. The suit involves the Casper-Alcova project now under construction in Wyoming by the Bureau of Reclamation. The court gave the defendant state 60 days in which to answer the complaint filed by Nebraska.

In the bill of complaint, Nebraska charges that Wyoming, through operation of the Pathfinder reservoir and the Guernsey reservoir, has obstructed the flow of water from the North Platte watershed, diminishing the direct flow of the river and illegally depriving Nebraska of water. The complaint also contends that the proposed Casper-Alcova project when completed would practically exhaust all of the flow above the Nebraska state line.

Further, the complaint charges that the water-right priority date allotted by Wyoming to the Casper-Alcova project, as of December 6, 1904, is "wholly and entirely fictitious." It is stated that the priority date to which the project is entitled to secure water rights "cannot be earlier than March, 1934," when the project was actually undertaken. Between the dates December, 1904, and March, 1934, 69,000 acres of land in Nebraska have been assigned water priorities, the complaint alleges.

The U. S. Supreme Court was requested, in the complaint, to enjoin and restrain the defendant state from permitting the impounding of water and to fix and determine the priority of the rights allotted to the Casper-Alcova project in relation to the priority established by Nebraska residents.

Western Society Makes Plans for New Activities

A FORWARD looking plan of activity for the Western Society of Engineers was outlined at the annual meeting on Oct. 8 by the incoming president C. C. Whittier. The program contemplates a closer relation between the society and the technical schools of the region through meetings arranged by the juniors of the society and members of the junior and senior classes in engineering. Educational programs concerning subjects not available in the regular scholastic courses are planned for late afternoon and evenings.

Another phase of development involves fundamental changes in the society structure, involving the formation of functional divisions which will not interfere with or overlap the activity of the eight technical sections. Already two have been formed and are active. One has its activities centered on history, and hopes to gather a worthwhile record of the life work and achievements in engineering of individual members of the society. This division will also administer the writing of engineering history and sponsor education in the science and art of teaching engineering history. Another division covers the activities of consulting engineers so far as it relates to such common problems as codes, unfair practices, "free" engineering and other factors challenging the future existence of the consultant. The division has enrolled many non-members.

Other functional divisions suggested are to be focussed on construction, inventions and patents, business administration and public works.

A. C. Willard, president, University of Illinois, presented a scholarly address on the relation of the University to engineering and industrial development of the state. He proposed a broader education of the student and young engineer and, to improve the professional status of the engineer, registration of all engineers and general adherence to the proposals of the Engineers' Council for Professional Development.

During the past year the society has held 29 meetings at which there was an average attendance of 123. A 10 per cent decline in attendance at the library was offset by an 11 per cent increase in the number of books consulted.

Charles Ellet cup

The Charles Ellet cup award for the best paper by a junior was presented to Irwin J. Kadic who made an abstract of the work done by CWA workers in preparing a basis for an Illinois state plan. Data were given showing the effects of transportation, power supply, communication, natural resources and manufactures on the progress of the state.

In addition to Mr. Whittier as president the following are the newly elected officials: Vice-presidents, Leigh S. Keith, C. R. Knowles and L. R. Howson, and treasurer, C. W. Haupt. Trustees are F. G. Gordon, E. P. Rich, L. R. Mapes, W. G. Arn, H. H. Cosley and J. R. Van Pelt. Three past-presidents, also members of the board of directors, are H. B. Gear, D. J. Brumley and Frank D. Chase.

Structural Steel Industry Code Granted Indefinite Stay by NRA

The code for the Structural Iron and Steel Fabricating Industry has been further stayed by the NRA. A new order provides an indefinite period before the code would become operative, pending the announcement of a further order by the National Industrial Recovery Board.

The code was approved July 11 and was scheduled to become effective July 22. In its final form, the code was rejected by the American Institute of Steel Construction (*ENR*, July 26, p. 122) and the effective date was stayed. On Aug. 6 a further stay of ten days was granted and the new order announced on Oct. 10 is retroactive to Aug. 16.

Chicago Set-back Law Upheld By U. S. Supreme Court

The U. S. Supreme Court has upheld Chicago's zoning ordinance relating to setbacks. As a result of the test case decision, part of the top twelve stories of a 20-story apartment at 40 East Oak St., built in 1928, must be torn down at an estimated cost of $500,000. The law calls for a setback of 1 ft. for each 9 ft. in height above the eighth floor, and the owner, relying on a permit from the zoning board, built without setbacks. Property owners across an alley sued six years ago claiming damage due to cutting off of light and air. The Illinois Supreme Court upheld the ordinance and the case went to the U. S. Circuit Court of Appeals which also upheld the ordinance. The situation is complicated because the property is in the hands of receivers. The Circuit Court ruled that monetary damages were not enough.

Madden Dam Gates are Closed and Reservoir Begins to Fill

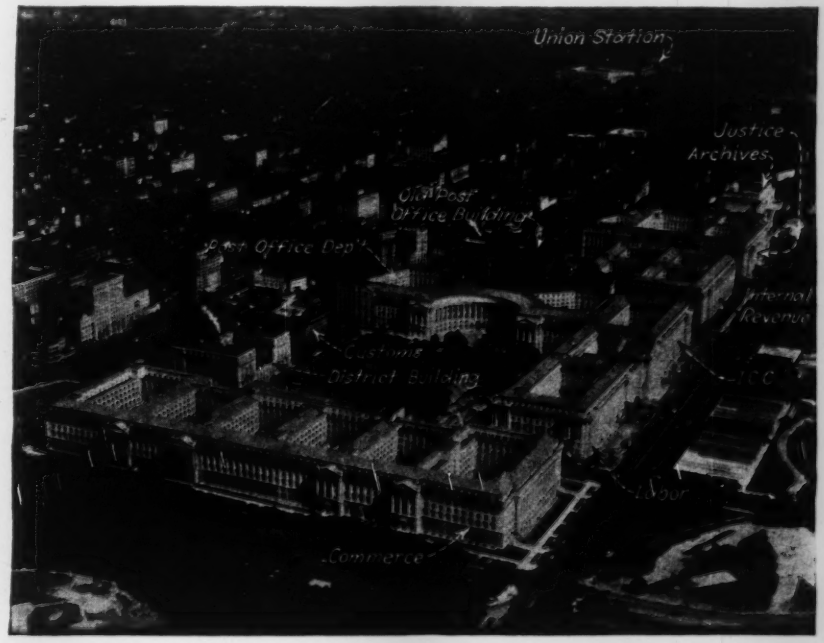
Storage has begun in the reservoir formed by the Madden Dam now nearing completion on the Chagres River in the Panama Canal Zone. The six sluice valves were closed Sept. 7 to secure as much storage as possible in the reservoir for the approaching dry season. The storage will supplement the water required for canal operations and provide flood control and power. When the valves were closed the water level behind the dam was at El. 99.5 above sea level and by Sept. 15 one week later, it had risen to El. 160. The present plans call for bringing the lake surface to El. 232 by Dec. 15.

The Madden Dam which is now approaching completion has been described in *ENR*, Dec. 8, 1932, p. 671.

WASHINGTON'S TRIANGLE SOON TO BE A DEPARTMENTAL CITY

Eight years of construction activity have brought the great group of departmental office buildings in Washington to virtual completion. Before another year the population of the Triangle, the name by which the area is popularly known, will be augmented many times as the personnel of the various governmental departments move into their new quarters. Bounded by Fifteenth St. (in front of the Department of Commerce Building), by Constitution Ave. (in the right foreground), and Pennsylvania Ave. (on the far side), the Triangle development is the most ambitious single unit in the plan for rebuilding Washington, which started two decades ago with the Union station.

At present, the Commerce and Internal Revenue buildings are finished and occupied. The Post Office Department Building was dedicated this summer. The Justice, Labor and Interstate Commerce Commission buildings are almost ready for tenants, and the Archives Building is scheduled for completion by early winter. The other buildings shown in the view are serviceable structures whose retirement has been discussd only vaguely. Likewise, no provision has been made for buildings on the still vacant plots although, with the exception of the one behind the Commerce Building, they have not been set aside for gardens and landscaping.



Land Acquisition Started for New York Slum Clearance Work

Initial steps in the Public Works Administration's low-cost housing and slum clearance program for New York City have been taken in the exercise of options in the neighborhood of Bushwick Ave. and Grand St. in the Williamsburg section of Brooklyn. Notification that their property will be taken up has been sent to a number of property owners who granted options to the Municipal Housing Authority. This step was taken after agreement between Horatio B. Hackett, director of housing, and Dwight L. Hoopingarner, associate director, representing the housing division of PWA in New York, and Langdon W. Post, chairman of the authority.

Under the terms of the agreement entered into by New York City, title to the land will be vested in the federal government, and the land leased on a long term basis to the Authority with option to purchase. Funds will be advanced out of the $25,000,000 fund set aside for New York City for payment for the land and for construction of the improvements.

The size of the Williamsburg project is dependent upon the extent to which New York will contribute schools, streets, park area and recreational facilities to the development, in accordance with the basic agreement. It will also be governed by the extent to which satisfactory prices are obtained for the land. Architectural details and the number and size of buildings for the project will await definite determination of the exact area.

Engineers Named to Help Enforce Licensing Law in N. Y.

At a recent meeting at Albany, six professional engineers, named by the New York State Society of Professional Engineers, were appointed by the education department to serve as special investigators in the enforcement of the engineers' licensing law. The appointees are: Fletcher H. Burke, Buffalo; Howard S. Thomas, Rochester; Harold J. Dawson, Syracuse; John J. Oakes, Andover; Howard W. Danfield, New York; George A. Dorfman, Brooklyn.

These special investigators will serve under the direction of Charles B. Heisler, director of the division of professional licensure of the state education department, and James O. Hoyle, investigator for the professions. Their duties will be to investigate any reported violations of the education law, which regulates the practice of professional engineering and which declares it unlawful to practice engineering or to use the designation engineer without a professional engineer's license.

Denver Water Board Authorizes Pay Increases for 1935

Increases in pay for employees of the Denver water board were authorized in the approval of the 1935 budget by the board. All salaries between $95 and $130 were increased $5 monthly, and the salaries ranging between $150 and $190 were increased by $10 a month.

This action was taken to bring water department salaries in line with those of the city administration whose pay reductions have already been restored.

Separate Division in NRA Urged By Construction Code Authority

A committee representing the construction industry held a conference Oct. 8 with the complete National Industrial Recovery Board and presented a resolution passed by the Construction Code Authority recommending the establishment of a construction division, adequately staffed, and in charge of an administrator completely empowered to decide all administrative matters. The committee was comprised of three members of the Construction Code Authority, Stephen F. Voorhees, chairman, A. E. Horst and H. R. Cole; also B. R. Value, executive director of the code authority, E. J. Harding, secretary of the Divisional Code Authority for General Contractors, and Sullivan W. Jones, chairman of the National Construction Planning and Adjustment Board.

At present the construction code is administered in the construction section of NRA, which is one section of Division 3. The decisions are subject to the criticism or approval of various advisory and policy boards in addition to higher administrative control, now the National Industrial Recovery Board.

Without establishing an official attitude toward any permanent form of NRA organization which may be proposed by the new legislative arm of NRA or develop during the next session of Congress, the Construction Code Authority is anticipating the effect of such plans upon the construction code and has authorized its executive committee to confer with the Industrial Emergency Committee (the Richberg Committee). Similarly, its representatives will confer with the proper authorities regarding reorganization of the code compliance and code enforcement functions under the judicial arm of NRA, plans for which are now in the making as announced by the President.

Building of House by Owner Ruled Under Contractors Code

Anyone assuming to perform the functions of a general contractor thereby becomes amenable to the code of fair competition for general contractors and is liable for the prescribed registration fee to the code authority of that division according to an NRA ruling denying a protest by a California owner against such an assessment on his house.

"Under the functional definition of the General Contractors Code," Assistant NRA Deputy Administrator Arthur G. Stanford stated, in replying to the protest, "you become a general contractor when you perform operations under the definition of their code and as such you are bound by the provisions of the code which specify that the general contractors code authority may assess a general contractor 1/10th of 1 per cent of the aggregate value of the work."

The decision clears the way for the Divisional Code Authority for General Contractors to demand the registration of all home construction, regardless of whether the owner dispenses with the services of a general contractor and supervises the project himself. Its effect is expected to be far-reaching in bringing all home construction under the provisions of the general contractors code.

Changes for San Gabriel Dam Recommended in Two Reports

Reports have been made public by the Los Angeles County Flood Control District from two boards of consulting engineers and geologists on the design and construction of San Gabriel Dam No. 1. The abandonment, some years ago, of the nearby Forks site for this dam and the stripping of 1,000,000 cu.yd. from the quarry developed for the rockfill structure now under contract had caused much public discussion about this work. Both reports approve continuing construction at the present site and both advise extensive changes in plans.

The Hill-Elliott-Sill-Tolman board appointed before the resignation of F. C. Eaton as chief engineer of the district, advocates using both stripping and waste from the quarry in a modified design involving flatter side slopes estimated to cost about $15,000,000. This report also advises investigating the feasibility of a combination earth and rockfill dam.

The Harza-Steele-Reed board proposes use of 1,000,000 cu.yd. to be excavated from the spillway and all quarry waste, but not strippings, in a modified rockfill with somewhat flatter slopes than formerly planned, concrete facing, graduation of fines from front to back and much larger spillway; all these changes are designed to be operative without the necessity for change in the present contract. This plan would increase the original volume of 6,000,000 cu.yd. in the dam to 7,500,000 cu.yd. but would utilize all material from the spillway and the existing quarry, and would not result in exceeding the funds that remain available for building the dam.

Control Surveys in Progress In Eighteen States

Local control surveys are being carried forward in eighteen states supplementing the work which was done last winter by the CWA. This work is being carried out under the direction of the Relief Administrators of the various states. There is only a casual connection between the U.S.C. &G.S. and the present state control work, according to William Bowie, chief of the Division of Geodesy. The C.&G.S. has no authority to require a similar degree of accuracy or direct the location of the surveys, but in practically every case the representatives of the national organization are assisting in this work.

Recently 500 men were put to work on this type of survey project in New Jersey and there are indications that the control surveying will be resumed in many states where the work was discontinued last winter or spring. The total number of persons now employed in this survey work is 1,970, and the recent augmenting of the force in New Jersey will bring the number to nearly 2,400.

In the interests of proper accuracy in these surveys, the Board of Surveys and Maps of the federal government on Sept. 11 passed a resolution requesting the chairman to communicate with the Public Works Administrator and recommend that a sufficient number of high-grade transits and tilting levels be purchased to equip the parties now engaged in this survey work. The cost of the instruments was considered small compared to the increased speed and accuracy which would be obtained with their use.

Engineering Staff Reorganized For Los Angeles Flood Control

Reorganization of the Los Angeles County Flood Control District engineering staff with an assistant chief engineer in charge of each of two sub-divisions of the district has been approved by the county board of supervisors. Under the new program, which was recommended by Samuel M. Fisher, chief engineer, one of the assistants will be in charge of the work in the mountain division and the other will direct operations in the valley area. Each of these two assistants will receive $6,500 a year.

H. E. Hedger, who has been on the engineering staff of the district since 1919 and held the position of office engineer for the past six years, has been appointed assistant chief engineer in charge of the valley division. Paul Baumann, chief designer with the consulting firm of Quinton, Code & Hill and Leeds & Barnard, Los Angeles, has been appointed assistant chief engineer of the mountain division.

Bids Are Opened for 110 Miles Of the Colorado River Aqueduct

Bids from twenty-nine contracting firms for constructing 110 miles of conduits, canals and siphons on the Colorado River aqueduct project were submitted to directors of the Metropolitan Water District of Southern California on Oct. 11. As soon as district engineers complete their analysis of the bids, their findings will be submitted to the district board of directors with the recommendations of F. E. Weymouth, chief engineer and general manager. Construction covered in the bids includes 120 siphons, totaling fourteen miles in length; thirty-four miles of covered conduit and sixty-two miles of lined canals. Estimated cost of this phase of the project is $35,000,000.

An unofficial and tentative listing of the apparent low bidders and their bids appears in the Construction Reports in this issue, page 28.

Conservation Work Done By CCC Valued at $236,000,000

Reports have been compiled by governmental departments indicating that the conservation, erosion control and reforestation work done by the Civilian Conservation Corps represents a value of $236,000,000. These statistics, compiled by the War, Interior and Agricultural Departments, according to Robert Fechner, director of emergency conservation work, represent the present value of the hundreds of miles of truck trails, the erosion control dams, the flood control projects and the improvement in forest areas which have been completed by the corps during the 16-months period for which figures are available. No attempt was made to indicate the benefits which accrued from the fire prevention activities of the CCC or the savings resulting from plant disease and insect control.

Among the work items completed by the CCC are: 21,000 miles of telephone line built and 28,000 miles maintained; 35,580 miles of truck trails and minor roads constructed; 1,250,000 acres of forest area improved; 150,000 acres of forest planted; 609,000 soil erosion prevention dams built; 995 lookout houses and towers built for forest fire control.

Tunnel Driving on Colorado Aqueduct Totals 33.8 Miles in Nine Months

Notable progress was made in driving tunnels on the Colorado River aqueduct for the Metropolitan Water District during the first nine months of 1934. For this period the total advance in 55 headings was 33.8 miles which brings the mileage of tunnels driven to date to about half the 91-mile total length of tunnels included in the 241-mile aqueduct from the Colorado River to the Los Angeles region.

These tunnels are 16 ft. in diameter. The old rule-of-thumb basis for rating fair progress in tunnels of this size, was one mile per heading per year of about 1,080 eight-hour shifts or an average progress of about 5 ft. per shift. On the Colorado River aqueduct tunnels, the nine-month record shows ten headings advanced more than one mile in nine months and 39 out of 55 progressed at more than the mile-a-year rate.

The formations through which the tunnels are being driven vary widely but in general the rock is gneiss, with intrusions of granite and granodiorite. The strata are badly contorted and fractured. Tunnel driving conditions and procedure were described in *ENR*, July 26, 1934, p. 97.

Detailed figures of driving progress from January to September follow:

TUNNELING PROGRESS RECORD JAN. 1-SEPT. 30 ON COLORADO RIVER AQUEDUCT
(All distances in feet)

Contractor & Tunnel		Total Length	Progress Jan. 1-Sept. 30	No. Shifts Worked	Av. Prog. per Shift (Ft.)
Walsh Construction Co.					
Colorado River		5,514	3,039	335	9.07
Copper Basin No. 1		752	752	111	6.77
" " " 2	East	1,878	1,609	238	6.76
" " " 2	West	9,702	6,352	804	7.90
Whipple Mt.	East	18,352	5,750	807	7.13
" "	West	13,913	4,950	793	6.24
Winston Bros. Co.					
Iron Mt. (E. Sec.)	East	9,844	2,680	698	3.84
" " (")	West	13,743	5,405	698	7.89
Utah Constr. Co.					
Iron Mt. (W. Sec.)		16,172	5,420	796	6.81
Winston Bros. Co.					
Coxcomb Mt.		17,795	5,443	698	7.91
Broderick & Gordon					
East Eagle Mt.		9,442	1,111	294	3.78
West " " (E. Sec.)	East	7,871	3,055	562	5.44
" " " (")	West	7,974	2,394	560	4.28
L. E. Dixon Co. & Bent Bros.					
West Eagle Mt. (W. Sec.)		10,649	5,249	700	7.50
Hunkin-Conkey Constr. Co.					
Hayfield Mt. No. 1	East	5,317	3,017	538	5.61
" " " "	West	4,360	2,631	478	5.53
Shofner & Gordon					
Hayfield Mt. No. 2		5,435	2,956	440	6.72
J. F. Shea Co.					
Cottonwood Mt.	East	10,114	5,972	701	8.52
"	West	9,991	5,921	705	8.40
Morrison-Knudsen Co.					
Mecca Pass No. 1		338	338	79	4.28
" " " 2		997	997	187	5.33
" " " 3		4,605	3,693	438	8.43
Metropolitan Water District					
East Coachella Tunnel		96,605			
Yellow Adit	East	10,204	5,268	696	7.57
" "	West	10,076	5,884	696	8.45
Fargo "	East	11,850	4,866	698	6.97
" "	West	15,200	3,702	696	5.32
Berdoo "	East	15,824	5,753	696	8.27
" "	West	12,456	5,562	696	7.99
Pushawalla Adit	East	10,186	4,814	696	6.92
" "	West	10,809	4,953	696	7.12
West Coachella Tunnels		81,454			
Thousand Palms No. 1		16,058	3,176	699	4.54
" " " 2		3,838	1,405	206	6.82
Wide No. 1	East	5,122	2,896	491	5.90
" " 1	West	9,183	4,549	696	6.54
" " 2		848	Holed through Oct. 3, 1933.		
Seven Palms	East	8,390	3,276	555	5.90
" "	West	8,340	3,263	404	8.08
Long		15,295	3,158	413	7.67
Blind		6,848	2,806	401	7.00
Morongo No. 1		5,712	2,266	358	6.33
" " 2		1,820	Not started.		
West Construction Co.					
Whitewater No. 1		2,060	135	25	5.40
" " 2		8,172	6,415	669	9.57
Wensel & Henoch					
San Jacinto Tunnel		67,415			
Cabazon Shaft	East	8,553	1,219	720	1.70
" "	West	22,839	4,488	738	6.08
Potrero "	East	20,589	160	129	1.24
" "	West	6,712	223	147	1.52
West Portal		8,722	2,395	813	2.95
Hamilton & Gleason Co.					
Bernasconi Tunnel		6,220	3,077	495	6.22
Dravo Contracting Co.					
Valverde Tunnel		38,765			
Shaft No. 1	East	2,140	2,129	470	4.53
" " 1	West	1,525	1,956	710	2.75
" " 2	East	5,400	3,211	756	4.25
" " 2	West	5,400	3,805	756	5.03
" " 3	East	6,950	1,436	654	2.20
" " 3	West	6,950	3,428	759	4.52
" " 4	East	5,117	44	22	2.00
" " 4	West	5,283	69	54	1.28

Brief News

ARIZONA has called for bids on the construction of nine miles of highway to provide the connecting link between the present highway system and Boulder Dam. This route will continue across the crest of the dam and provides a new road into Nevada.

NORRIS DAM is expected to be completed in about 20 months, according to recent estimate made by the TVA. This period compares with the original estimate of a four-year construction period made when the work was started last year.

A REGIONAL AGREEMENT submitted to the NRA by the plastering and lathing division of the construction industry in Dallas County, Texas, will be discussed at a public hearing held in Dallas, Oct. 25, before representatives of the NRA. The agreement involves wages and hours. A public hearing will be held Oct. 26 in Cincinnati, Ohio, on a regional labor agreement submitted by the tile contracting division of the construction industry to NRA.

A MAJOR CONTRACT for electrical equipment for use in the operation of the power transmission line built by Los Angeles from Boulder Dam was awarded Oct. 9 by the Board of Water and Power Commissioners to the Westinghouse Electric & Manufacturing Co. The contract involves stepdown auto transformers costing $952,000.

A WRITTEN EXAMINATION for registration of civil engineers in Wisconsin will be held in the State Capitol, Madison, Oct. 24-26. Arthur Peabody is secretary of the state board of examiners of architects and civil engineers and applications to take the examination must be received by him before Oct. 20.

BUILDING CONSTRUCTION in Richmond, Va., for the first nine months of the year exceeded the figure for the entire twelve months of 1933. Up to Sept. 30, 1934, permits were $1,033,518 and for the year 1933 they were $1,024,615.

SEVERE RAINS in the Shenandoah Valley, Va., during the first week in October resulted in severe damage. An estimate indicates that the damage to highways exceeded $1,000,000, with ten bridges washed away in Halifax county and many secondary bridges damaged in Lancaster county.

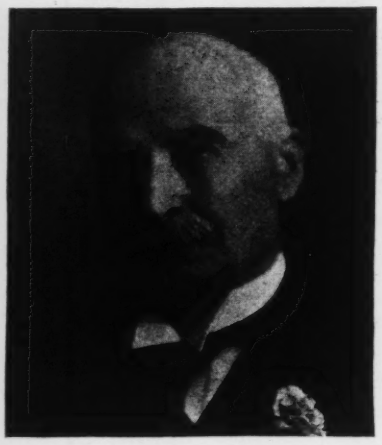
A HIGHWAY CONTRACT of $339,260 has been awarded to the Codell Construction Co., Winchester, Ky., by the Kentucky highway commission for surfacing 13.6 miles of highway in Whitley county. This was the largest single contract let on Oct. 9 when the commission awarded contracts totalling more than $1,000,000.

APPLICATION for license to construct three dams on the White river in Arkansas has been filed by the White River Power Co. with the Federal Power Commission. The development would provide an ultimate installed capacity of 150,000 hp. The contemplated development program has been under consideration for many years.

A PROPOSED charter amendment to permit transfer of 8 per cent of the gross earnings of the Pasadena, Calif., municipal light department to the city's general fund for retirement of the city's bonded debt will appear on the municipal ballot Nov. 6. Under the terms of the proposed amendment, this transfer would be in effect for four years.

M. M. O'Shaughnessy Dies As Hetch Hetchy is Completed

M. M. O'Shaughnessy, one of the outstanding municipal and water supply engineers of the country and widely known as the "builder of Hetch Hetchy," San Francisco's water supply and power development, died in that city Oct. 12, at the age of 70. The tragic touch is the fact that the ceremony marking the completion of this project is scheduled for Oct. 28, at which time Mr. O'Shaughnessy would have witnessed the dedication of the undertaking that he had directed over a 20-year construction period—literally, his life work. In addition to his 20-year period of service



M. M. O'Shaughnessy

as city engineer for San Francisco, Mr. O'Shaughnessy had wide and varied engineering experience in other sections of California and in the Hawaiian Islands for two decades previous to his return to San Francisco to be head of its engineering department.

M. M. O'Shaughnessy was born in Limerick, Ireland, in 1864, and graduated with honors from the Royal University, Dublin, in 1884. He came to this country the following year and his first engineering position was assistant engineer for the Southern Pacific Company on railroad work in California in 1886-7. Following several years of general engineering work he became chief engineer of the California Midwinter International Exposition, San Francisco, 1893-4, and then after two years of private practice in San Francisco, he became consulting hydraulic engineer for a group of sugar plantations in Hawaii and carried out some extensive dam construction and tunnel work for this organization from 1899 to 1906.

Returning to California, Mr. O'Shaughnessy became chief engineer of the Southern California Mountain Water Co., and carried out a water development program for this company in the region around San Diego, including the construction of the well-known Morena rockfill dam. In 1912 when this work was nearing completion he was appointed to the position of city engineer of San Francisco at a time when the ultimate water supply program for that municipality was under active discussion. In this position he directed all municipal engineering work which included the completion of the Municipal Railway, construction of the Twin Peaks and Stockton Street tunnels, in addition to street and sewer work; but his principal work and best known accomplishment of the following 20-year period was the planning and building of the Hetch Hetchy water supply system. The largest single construction unit of this undertaking was the main storage dam which was named O'Shaughnessy Dam in his honor. Completion of this notable water supply undertaking was the subject of a special issue of *Engineering News-Record*, August 2, 1934.

Mr. O'Shaughnessy was particularly well known for his disregard for politicians and political methods in the carrying out of engineering work. His energy and demand for action are well illustrated by a statement which appeared in a San Francisco newspaper less than one month after he took office as city engineer in 1912. In referring to the new engineer as a man of action, the account stated "he has not waited for the report of his subordinates, sat in his office and studied blueprints and then compiled an elaborate and technical report without personal knowledge of the subject matter. Nothing of the kind for this virile man. He investigates personally; visits the spots where a correction is needed, makes a hasty, though no less accurate survey; arrives at his conclusions; tells what should be done, and then lets his accurate measurements and blueprints follow later; and practical and theoretical are combined with good results." This same type of energetic engineering effort characterized his carrying out of the Hetch Hetchy program.

Mr. O'Shaughnessy was a member of the American Society of Civil Engineers and was president of the San Francisco Section in 1920. He was awarded the James Lourie prize in 1913 for his paper "Construction of the Morena Rock Fill Dam, San Diego, Calif."

Personals

H. A. WORTHAM, president of the Wortham Construction Co., Louisville, Ky., has been appointed engineer-inspector of the PWA in Kentucky and Tennessee. His headquarters will be at Nashville.

ANDREW J. KENNY has been placed in charge of the Bureau of Sewers of Queens County, New York City, replacing James Lunn. Mr. Kenny was previously head of the Bureau of Highways.

A. W. GEORGE, Dallas, Tex., a recently appointed engineer-inspector of the PWA for the region of Arkansas, Louisiana and Mississippi, has established headquarters in Little Rock, Ark.

W. H. BARTLETT, West Palm Beach, Fla., has been appointed engineer of the Jacksonville sector for the Florida Emergency Relief Administration.

WILLIAM J. PARDEE, formerly city manager of Visalia, Calif., has been appointed city manager of Monterey, Calif., succeeding R. M. Dorton who accepted the city managership of Long Beach.

WILLIAM SHANNON, for many years construction engineer for the Stone & Webster Corp. on the Pacific Coast, and in charge of the Rock Island hydroelectric development on the Columbia River has been named deputy administrator for the lumber industry in the Northwest.

R. C. HARDMAN, formerly assistant state engineer-inspector of the PWA for Idaho, is now engineer-inspector of the

PWA for the states of Colorado, Utah, Wyoming, Montana and Idaho, with headquarters in Denver, Colo.

CECIL E. PEARCE, for the past six years chief designing engineer for the Pine Canyon (Morris) Dam, built by Pasadena, Calif., has been appointed hydraulic engineer for the Tennessee Valley Authority. He will work on plans for the future dam program of the TVA.

R. B. WILLIAMS has been named construction engineer for the All-American canal project of the Bureau of Reclamation. He succeeds Ray Priest who died several months ago. Mr. Williams has been with the Bureau of Reclamation organization for more than 20 years, and served for several years on construction of the Kittitas division of the Yakima project in Washington, followed by two years at Boulder Dam and more recent work on investigations for the proposed Verde project. His headquarters will be at Yuma, Ariz.

Obituary

HENRY T. WHEELOCK, former superintendent of the Lynn (Mass.) water department, died at his home in Lynnfield Center, Mass., Oct. 9. He was 69 years of age and retired from active service six years ago.

HAROLD DE WOLFE HATFIELD, head of the civil engineering department of Rutgers University, died Oct. 13 at the age of 46. He was a native of Canada and a graduate of the Connecticut State College in 1910, with a higher degree from George Washington University in 1915. From 1918 to 1922 he was vocational supervisor for the Veterans Bureau. In 1928 he was appointed professor of industrial engineering at Rutgers and two years later was made head of the civil engineering department.

REUBEN DAVIS, formerly vice president and metropolitan manager of the Foundation Co., New York, died in New Rochelle, N. Y., on Oct. 15 at the age of 55. Mr. Davis was well known in foundation and building work in New York City and was a recognized authority on geological and foundation conditions in that area. He was born in Pittsburgh in 1879 and graduated from Rensselaer Polytechnic Institute in 1903. His entire professional career was spent in New York, divided between work with Daniel E. Moran, consulting engineer, and the Foundation Co. organization. He retired from active work in 1931.

CONSTRUCTION STATISTICS OF THE WEEK

ENGINEERING awards total $25,187,000 for this week, of which $3,424,000 are for federal work, $15,979,000 for state and municipal and $5,784,000 for private. This private volume exceeds the average October week a year ago and is substantially higher than the previous four weeks average. Federal awards continue much lower than a year ago, this week being 78 per cent below the average October week a year ago. State and municipal awards are running 14 per cent ahead of a year ago.

Highway awards for this week at $8,846,000 are the highest since the week ending May 17; waterworks at $1,062,000, sewerage at $1,920,000, industrial buildings at $1,152,000, commercial buildings at $2,308,000 and earthwork, irrigation, drainage and waterways at $2,178,000 are all substantially ahead of last week. Bridges at $2,350,000, and public buildings at $2,216,000 are slightly below last week.

The larger awards for this week include: 250 residences for R. A. Nordblom, Inc., Braintree, Mass., $1,200,000; state highway lettings by Missouri, $1,229,000 and by New York, $2,168,000; sewage disposal plant and collector system, Fargo, N. Dak., $663,000; sewers, Clarendon, Arlington Co., Va., $494,000; Dam 6, Mississippi River, Trempealeau, Wis., $1,668,000; and gas pipe line, Lone Star Gas Co., Dallas, $2,000,000.

New capital for the week is very low, only $776,000 for state and municipal bond sales. PWA allotments are limited to a total of $499,000 for federal projects which includes $45,000 for completing 4 Coast Guard cutters. The $5,000,000 issue of 5 per cent semi-annual flood control bonds, Los Angeles County Flood Control District, offered on October 8, failed to obtain a bidder. Last month a $2,000,000 offering of water bonds of the same city failed to secure a bid. This situation, according to some financial authorities, results from the present political situation in that state.

CONTRACTS

(Thousands of Dollars)

	Weekly Oct. 1933	Average Prev. 4 Weeks	Week Oct. 18 1934
Federal Government	$15,604	$4,138	$3,424
State and municipal	14,065	16,188	15,979
Total public	$29,670	$20,326	$19,403
Total private	5,733	3,984	5,784
Week's total	$35,405	$24,310	$25,187
Cumulative to date:			
1933	$790,839	1934	$1,020,404

NEW PRODUCTIVE CAPITAL

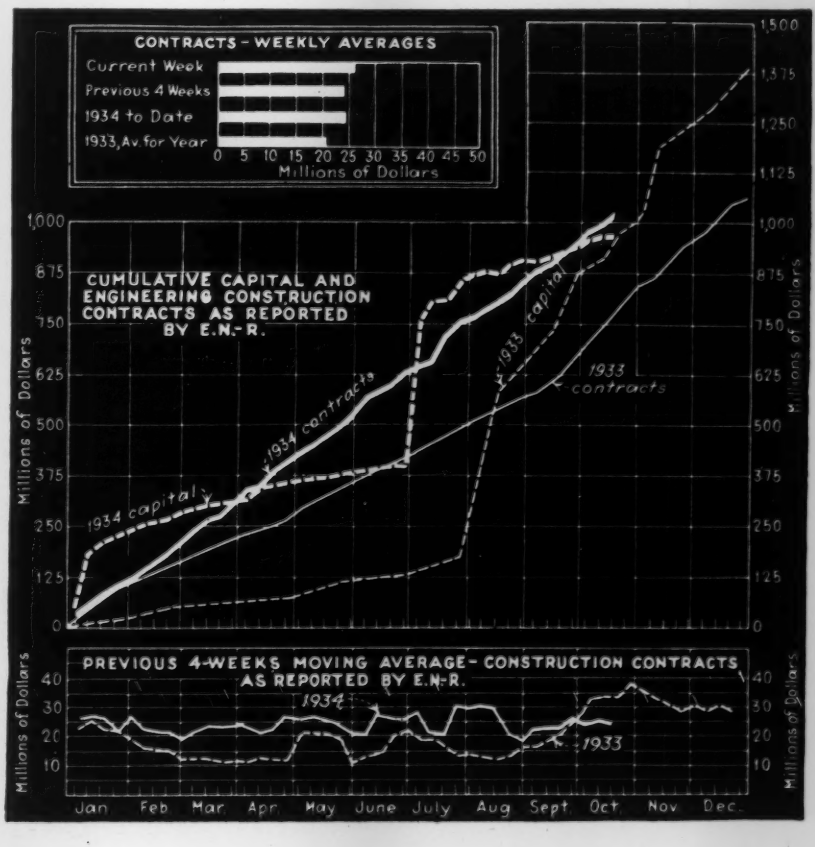
(Thousands of Dollars)

1934	Week Oct. 18	Cumulative
State and municipal	$776	$264,409
PWA allotments, S&M	....	605,905
RFC loans, S&M	....	25,463
Corporate issues	....	18,256
PWA allotments, private	....	57,022
Total, Non-Federal	$776	$971,055
PWA allotments, Federal Constr.	499	189,287
Total new capital	$1,275	$1,160,342
Cumulative to date:		
1933	$968,490	1934	$971,055

Note: These figures include private bonds, and stocks sold for productive purposes; state and municipal bonds for construction; PWA loans and grants to states and municipalities, including the special highway funds; PWA private loans, and allotments for Federal construction.

INDEX NUMBER

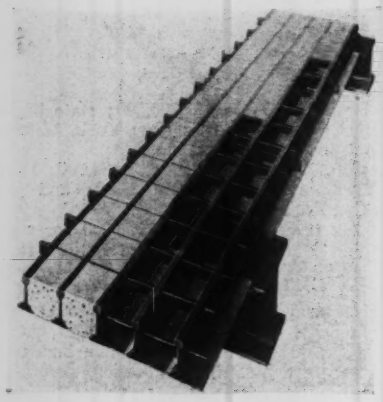
E.N.-R.- Cost	1913 = 100	1926 = 100	E.N.-R.- Volume	1913 = 100	1926 = 100
Oct., 1934	200.86	96.55	Sept., 1934	101	44
Sept., 1934	200.58	96.41	Aug., 1934	94	42
Oct., 1933	187.74	90.24	Sept., 1933	122	53.5
1933 (Av.)	170.18	81.80	1933 (Av.)	102	45
1932 (Av.)	156.97	75.45	1932 (Av.)	127	56
1931 (Av.)	181.35	87.17	1931 (Av.)	220	96.5



Construction Equipment and Materials

Steel-and-Concrete Slab For Bridge Roadways

A combination steel and concrete bridge roadway slab or heavy duty floor, designated I-Beam-Lok, has been announced by the Carnegie Steel Co., Pittsburgh, Pa. The construction is a series of alternating I-beams and concrete ribs tied and locked together by a number of notched cross bars near both the top and bottom surfaces of the slab. In addition, the top bars form a part of the integrally armored surface.



Carnegie Steel Co.'s I-Beam-Lok

Metal form strips, fitted between the lower flanges of the I-beam, provide a tight form work for the concrete.

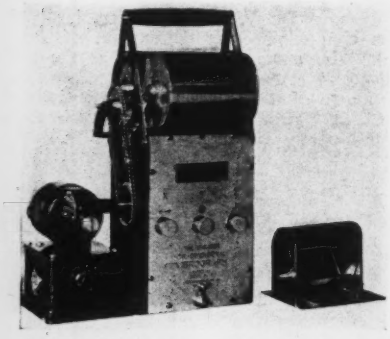
The webs of the I-beams are punched for the insertion of the cross bars. The slab is so designed as to have constant moment of inertia for resisting both positive and negative bending moment stresses. The notched cross bars are first inserted flat in L-shaped web holes, then turned through an angle of 90 degrees, and tack-welded in their final position.

When filled with concrete, the slabs weigh 47 lb. per sq. ft. in 3 in. depths, and 53.5 lb. per sq. ft. in 3½ in. depths. The weight of the steel used is 15.5 lb. per sq. ft. in the 3 in. depth and 16.4 lb. in the 3½ in depth.

New Machine Records Vibration Components

A new piece of apparatus has recently been made available by the Vibration Specialty Co., Philadelphia, Pa., which records photographically on a moving film the components of vibration in three dimensions simultaneously. The record shows the amplitude, wave form, phase relation and frequency of three components. It is known as the Tri-Dimensional Vibrograph. Its field of service includes the study of vibrations of machinery and building foundations.

A form of seismograph, the instrument comprises a heavy mass suspended in the frame by a system of springs and a means for indicating and recording the relative motions between mass and the frame. When placed upon any vibrating body the frame vibrates with the body while the mass, due to its inertia, tends to remain at rest. The mass weighs about 8 lb., and the elastic properties of the springs are such that the natural period of vibration in



VIBROGRAPH, for recording photographically the components of vibration in three dimensions. For preliminary observations the film holder is replaced by the rotating mirror shown at the right.

the mass in each of the three directions is about 140 vibrations per minute.

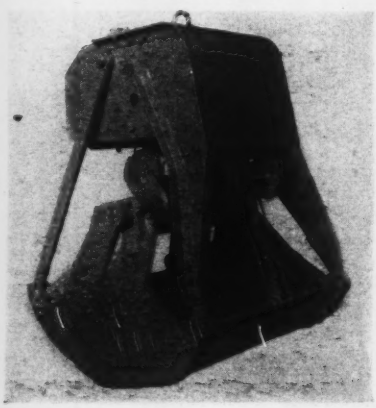
Relative motion of the suspended mass and the frame result in the rotation of three spindles carrying mirrors which reflect images of a lamp filament upon a screen or photographic film. Two of these spindles are mounted in a vertical position, and the third in a horizontal position.

To secure a timing record on the film a fourth mirror is mounted stationary on the frame in such a manner that the light is reflected to the photographic film. A slotted disk, driven by a small motor intermittently intercepts this light, so that a record is made at intervals of 1/2000 of a minute, making a timing record in the form of a succession of small dots alongside the record of vibration.

Motor-Driven Bucket

A motor-driven bucket known as the Strayer Electric Bucket has been announced by the Erie Steel Construction Co., Erie, Pa. A motor and brake are mounted in the head of the bucket and enclosed by heavy steel plate, the cover of which can be removed for inspection.

Strayer electric bucket



The mechanical features of the bucket are such that equal strains are maintained on the four corners when digging, thus preventing warping of the bucket. The scoops are of heavy plate, reinforced with hardened cutting edges and backbands having riveted connections to the hinge members. All castings are of annealed acid electric steel. Sheaves are of extra large diameter and rotate on large bearing surfaces.

The electrical design is such that there are only two conductors between the bucket and the operating panel in the cab. The bucket is available in capacities from ½ to 3 cu.yd.

New Equipment in Brief

Floor Repair. Stonhard Co., Philadelphia, Pa., announces the new Stonhard resurfacer. The company states that by its use concrete, wood, brick, asphalt or composition floors can be repaired or resurfaced and ready for use within 36 hours.

Tractor-Trailer. The Euclid Road Machinery Co., Cleveland, Ohio, has announced the new Euclid Trac-Truk, combining a pneumatic-tired tractor and bottom dump trailer. The tractor is powered with a 100 hp. engine. The trailer has a capacity of 6 yd.

Blasting Machine. The Atlas Powder Co., Wilmington, Del., announces the development of the "Twin Fifty" blasting machine. The machine is designed to allow the firing of two series of blasting caps separated by an extremely short time interval. The machine also fires a single series equally well.

Material Spreader. The Jaeger Machine Co., Columbus, Ohio, announces the Vibro-Spreader for use in constructing secondary roads. The machine makes use of a screed vibrated at 3,500 per minute, 15 ft. long sled runners which act as forms and a telescopic main frame used in combination with screed extension wings to give 9 to 14 ft. width adjustability.

Air Compressor. Ingersoll-Rand, Phillipsburg, N. J., has recently doubled its line of two-stage, air-cooled portable air compressor. All six sizes are now avialable with oil-engine drive, as well as with gasoline-engine drive. The oil engine, known as the Type H is a 4-cycle, solid-fuel-injection, spark-ignition engine. The compressors are built with capacities of 75, 125, 185, 250, 370 and 500 cu.ft. per minute.

Business Notes

REVERE COPPER & BRASS, INC., New York, N. Y., has opened a new office in Atlanta, Ga., at 911 Rhodes-Haverty Building.

STEPHENS-ADAMSON MFG. CO., Aurora, Ill., announces that L. S. Stephens has been elected to succeed D. B. Pierson as president.

REPUBLIC STEEL CORP., Youngstown, Ohio, announces the appointment of Stanley A. Knisely as advertising and sales promotion manager.

THE MARLIN-ROCKWELL CORP., Jamestown, N. Y., have opened a branch factory at 550 Polk St., San Francisco, Calif. James Ross Brown has been appointed branch manager.

THE ALUMINUM COMPANY OF AMERICA and the CHICAGO BRIDGE & IRON WORKS have each acquired an interest in the AMERICAN LUMBER & TREATING COMPANY. The latter organization, which has headquarters in Chicago, builds and operates plants for treating lumber with Wolman salts.

CONSTRUCTION REPORTS

WATERWORKS

PROPOSED WORK

Calif., Arcata—City voted to issue $90,000 general obligation bonds for purchase and improvement of water system now owned by Public Utilities California Corp. System will be purchased for $75,000 balance of issue for improvements. Noted Sept. 27.

Ill., Beardstown—City postponed until fall of 1935 improving waterworks and distribution system. Election for $68,000 bond issue indefinitely postponed. Allen & Vagtborg, 205 Wacker Dr., Chicago, engrs. Noted July 13, 1933.

Ill., Mattoon—City, J. A. Goetz, supt. Water Dpt., plans filtration and softening plant, $56,000; wash water tank $5,000; repairing old plant $2,000; elevated storage tank $18,000; extending distribution mains $9,000. $100,000 grant and loan allotted by P.W.A. but not yet accepted. Engineer not appointed.

Kan., Osawatomie—City plans water and electrical light plant. $166,000. P.W.A. withdrew loan and grant. Burns & McDonnell Eng. Co., 107 West Linwood Blvd., Kansas City, Mo., engrs. Noted July 19.

Ky., Eddyville—Municipality plans pumping plant addition. $40,000. P.W.A. project. J. S. Watkins, Lexington, engr.

Ky., Manchester—City plans completed and soon takes bids complete waterworks system and earth dam. $50,000. Black & Veatch, 700 Mutual Bldg., Kansas City, Mo., engrs.

Md., Annapolis — Annapolis Metropolitan Comn., Municipal Bldg., making plans 1 story, brick pumping station. $50,000. Whitman, Requardt & Smith, Charles and Biddle Sts., Baltimore, consult, engrs. R. Burwell, Municipal Bldg., engr.

Mich., Morenci—Village election Nov. 10, $20,000 bonds, municipal waterworks. G. C. Daily, Morenci, engr. P.W.A. project. Noted Aug. 17.

Mo., Paris—City returned unopened bids to have been opened Oct. 4, constructing waterworks improvements, incl. 100,000 gal. steel tank on tower, and 1.1 mi. main extensions. Will readvertise. P.W.A. project. W. B. Rollins & Co., 339 Railway Exch. Bldg., Kansas City, engrs. Noted Sept. 27.

N. J., Woodbury—City rejected P.W.A. allotment for constructing waterworks. $63,631. F. F. Kaufman, 809 Pine St., Camden, engr. Noted Oct. 4.

N. Y., Jordan—Village making surveys of municipal water supply, plans either repairing or reconstructing 500,000 gal. reservoir, and connecting existing system either with that of Elbridge or Skaneateles. S. N. Grimm, c/o Village Bd., engr.

N. Y., Irvington—Municipality plans waterworks, $53,000. P.W.A. loan and allocation amended to $52,300. W. C. Jago, 16 South D St., Irvington, engr.

O., Cuyahoga Falls—City retained R. F. MacDowell, engr., Chester-Twelfth Bldg., Cleveland, to make investigation and report for water softening plant and waterworks improvements.

Okla., Ardmore—City election Oct. 27, to vote bonds, water purification plant. $36,000. S. Mathews, Ardmore, engr. Noted Aug. 2.

Okla., Broken Arrow—City voted bonds extending watermains. $16,000.

Okla., Durant—City voted bonds for waterworks. $19,000. W. B. McMasters, 603 West Main St., Oklahoma City, engr. Noted Aug. 31, 1933.

Okla., Woodward—City voted bonds for waterworks improvements, park and street improvements, $20,000. Will be used as part of F.E.R.A. relief program. Private plans.

Tex., Dallas—W. R. Younger, mayor, submitted plans to P.W.A. for approval for deep water well and pump house, wrought steel pipe waterworks improvements. $15,000. F. J. Von Zuben, Fair Bldg., Fort Worth, engr.

Utah, Fountain Green—City plans replacing present wood pipe distribution system with c.i. pipe. $40,000. Caldwell & Richards, Templeton Bldg., Salt Lake City, engrs. Noted Feb. 8.

Ont., Windsor—City Water Comrs., G. C. Storey, mgr., plans watermain Langlois Ave. $50,000.

BIDS ASKED

Ill., Ashland—Nov. 9, by Village, Village Hall, waterworks. $95,000. P.W.A. project. Warren & Van Praag, Inc., Milliken Bldg., Decatur, engrs.

Ill., Hillview—Oct. 25, by Bd. Comrs., C. Arnold, secy., at office County Clerk, Carrollton, rebuilding pumping station, etc., $83,000. P.W.A. project. Caldwell Eng. Co., 211 East State St., Jacksonville, engrs.

Ill., Illipolis—Oct. 30, by O. Middlekauff, pres. Bd. Village Trustees, waterworks, $49,000. P.W.A. project. Warren & Van Praag, Milliken Bldg., Decatur, engr.

Ill., Morrisonville—Nov. 2, by Bd. Village Trustees, G. W. Ferguson, pres., waterworks, $31,000. Warren & Van Praag, Millikin Bldg., Decatur, engrs.

Ill., Williamsville—Nov. 8, by Village, W. Patterson, pres. Bd. Trustees, waterworks, $47,000. P.W.A. project. Warren & Van Praag, Milliken Bldg., Decatur, engrs.

Ind., Bluffton—See "Contracts Awarded."

Massachusetts—Nov. 13, by Commonwealth of Massachusetts, Metropolitan Dist. Water Supply Comn., 20 Somerset St., Boston, F. E. Winsor, ch. engr., constructing dike of Quabbin Reservoir in towns of Enfield and Ware, embankment to be 2,140 ft. long, 135 ft. high and requiring about 2½ million cu.yd., about ¾ of which must be placed hydraulically; concrete caisson cut-off has been constructed to ledge across the valley bottom under previous contracts. Work includes placing and consolidating foundation embankment in preparation for hydraulic sluicing, placing concrete over and grouting ledge rock on 2 hillsides, placing rip rap on upstream and soil dressing on downstream faces, building roads and other appurtenant works. N. Le Roy, Hammond, div. engr.

Mass., Somerville—Oct. 22, by City, J. E. Mullaney, engr., City Hall, installing c.i. watermains, Proposal 1, Glenn and Joy Sts., Proposal 2, Kimball and Lowell Sts; Proposal 3, Porter and Crown Sts., P.W.A. Project Docket 7636. $50,000.

Mo., Carthage—Oct. 24, by City, 2 m.g.p.d. water softening plant, equipment, auxiliary piping, etc., $107,000. Black & Veatch, 700 Mutual Bldg., Kansas City, engrs. Noted June 5.

N. Y., Falconer—See "Contracts Awarded."

N. Y., Ovid—See "Contracts Awarded."

Tex., Fairfield—Oct. 29, by City, H. L. Williford, mayor, waterworks system, 10 mi. distributing lines, pumping unit, tank and tower, etc., $70,000. P.W.A. project. H. B. McAllister, 914 Washington St., Waco, and H. S. Helland, 1002 Frost Bldg., San Antonio, engrs.

Tex., Three Rivers—City taking bids waterworks improvement, 150,000 gal. steel tank on 100 ft. steel tower, water softening plant, 2 mi. mains, meters, fire plugs, etc. $26,000. P.W.A. project. A. A. Ririe, 622 West Woodlawn Ave., San Antonio, engr.

CONTRACTS AWARDED

Ark., Cotton Plant—City, waterworks, incl. distribution system, to L. O. Brayton, Dyersburg, Tenn., $41,767***well, to B. M. Hogan, Little Rock, $2,473***tank on tower, to Pittsburgh-Des Moines Steel Co., Praetorian Bldg., Dallas, Tex., $7,650. Grand total $51,890. **P.W.A.**

Ark., Waldron—City, deep well for waterworks system, to Well Works Mfg. Co., Garden City, $1,525. **P.W.A.** Dickinson & White, Rector Bldg., Little Rock, engrs.

Ill., Homewood—Village elevated tank for waterworks, to Chicago Bridge & Iron Co., 37 West Van Buren St., Chicago, $15,395; softening plant, to Sides Constr. Co., 844 Rush St., Chicago, $27,976. **P.W.A.** Bids Sept. 21. Noted Sept. 13.

Ind., Bluffton—City, 2 strainers for intake pipes, day labor. E. Hans, Bluffton, supt.

Ia., Oskaloosa—Municipal Water Bd., constructing soft water system and plant improvements, on South Chiquaqua River, north of here, to McKey Fans-Her Co., P. W. Sparks, Carlon Constr. Co. and Jones Constr. Co., Oskaloosa, $64,199***material contracts, to W. McClurg, Iowa Valve Co. and R. F. Fiteh Co., Oskaloosa, $1,846. Est. $95,000. **P.W.A.** Bids Sept. 29. Noted Sept 13.

Massachusetts—Commonwealth of Massachusetts, Metropolitan Dist. Comn., D. B. Keniston, comr., 20 Somerset St., Boston, constructing water pipe tunnel under Mystic River, to Peter F. Connolly Co., Chatham Phoenix Bldg., Long Island City, N. Y., $63,945. Bids Aug. 23, awarded Oct. 9.

Mass., Barnstable — Town, C. Jones, chn. Special Water Comn., furnishing, laying 6¼ mi. 6- to 12-in. c.i. pipe lines and constructing 200,000 gal. steel storage tank, furnishing pipe, to Warren Pipe Co. of Massachusetts, 75 Federal St., Boston***laying pipe, to H. S. Jones, Barnstable***constructing standpipe, to Chicago Bridge & Iron Wks., 250 Stuart St., Boston. Noted Aug. 16.

Mass., Onset—Prudential Com., Onset Fire Dist., P. C. Charnock, engr., 16 Jackson St., West Medford, valves, to Chapman Valve Mfg. Co., 71 A St., South Boston***fittings, to Builders Iron Fdry., 9 Codding St., Providence, R. I.***c.i. pipe, to Florence Pipe & Fdry. Co., Phila., Pa.***hydrants, to Darling Valve Co., Williamsport. All above materials in connection with watermains by day labor. Total cost about $20,000. **P.W.A.**

Mass., Quincy—City, Water Dpt., City Hall, constructing 2 booster stations, to Anthony Ross & Son, 97 Bedford St., Lexington, $16,350. Bids Sept. 25, awarded Oct. 9.

Mich., Detroit—Dpt. Water Supply, dredging an access channel in Detroit River to Waterworks Park, removing section of intake pipe near dock and restoring intake dyke lagoons east of Belle Isle, to Candler Dock & Dredging Co., 8145 Medina Ave., $54,800. **P.W.A.** Bids Oct. 2, awarded Oct. 11. Noted Sept. 20.

Mo., Hayti—City, filter plant, incl. 28x53x12 ft. rein.-con. basins, filters, clear well, 365 cu. yd. earth excav., etc. Sect. 1; pipe work, valves, fittings, Sect. 2; 3 dry chemical food machines, 1 solution feed type chlorinator, one 350 g.p.m. motor-driven centrifugal pump, 1 altitude pump, 1 indication liquid level gage, Sect. 3; furnishing, laying c.i. pipe, gate valves, boxes, nozzle fire hose, Sects. 4 and 5, to Dunbar & Simon, 7520 Buckingham Dr., Clayton, $21,410. Est. $22,800. **P.W.A.** Bids Oct. 1. Noted Sept. 20.

Mo., Memphis—City, two 150,000 gal. per day filter units complete, 3 pumping units, building, and 170 cu.yd. concrete work, to J. Whitehead, Kahoka. **P.W.A.** Bids Oct. 5. Noted Sept. 27.

Mont., Fairview—City, complete waterworks system, to J. C. Boespflug, Miles City, $42,545. **P.W.A.** Bids Aug. 23.

Mont., Glendive—City, improving water softening plant, incl. 1 well with pumping equipment, flocculator, siphon-feed central-drive clarifier, sludge pump, recarbonization equipment, etc., to J. Sterhan, Glendive, $19,235. **P.W.A.** Bids Oct. 1. Noted Sept. 27.

Neb., Kenesaw—City, 11,952 lin.ft. 2- to 4-in. pipe, to National Cast Iron Pipe Co., Land Bank Bldg., Kansas City, Mo., $5,088***eight 4 in., two 6 in. and fourteen 4 in. hydrants and gate valves, to Iowa Valve Co., Oskaloosa, Ia., $831***general work, laying pipe, etc., to R. Beal, Kenesaw, $3,990. Grand total $9,909. Bids Sept. 28.

Neb., Lincoln—City, filter equipment for iron and manganese removal plant, to E. W. Bacharach & Co., Rialto Bldg., Kansas City, Mo., $35,600; pump and control equipment, to Dayton-Dowd Co., Quincy, Ill., $9,018.

Neb., Oconto—City, constructing well and furnishing, erecting pumping equipment for waterworks, to J. F. Sears, Callaway, $1,523; material, to Interstate Mchy. & Supply Co., 1006 Douglas St., Omaha, $846. **P.W.A.** Nixon & Reynolds, Grain Exch. Bldg., Omaha, engrs.

N. H., Claremont—Town, Bd. Selectmen, Town Hall, constructing concrete, earth reservoir and appurtenant pipe lines, day labor under supervision of Superintendent of Waterworks. Est. $50,000.

N. J., Totowa—Dpt. Institutions & Agencies, State Bldg., Trenton, water tower at North Jersey Training School, to Pittsburgh Des Moines

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Federal Government projects are classified under heading denoting type of work and designated by symbol of †

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†*Federal Government.*

Waterworks (Continued)

Steel Co., 270 Bway., New York, $7,100; waterlines, to Frazza Constr. Co., 62 East 15th St., Paterson, $2,400. Bids Sept. 19.

N. Y., East Bloomfield—Village, constructing pipe line for waterworks system, to C. Schoen, 36 North Main St., Pittsford, $7,151***pump station and foundations, to S. S. Caves, Holcomb, $7,835***standpipe, to Chicago Bridge & Iron Wks., Buffalo, $3,265***hydrants, valves, etc., to W. A. Case & Son Mfg. Co., 82 St. Paul St., Rochester, $2,411***pumping equipment, to A. L. Covill, 130 East Main St., Rochester, $12,950***c.i. pipe, to U. S. Pipe & Fdry. Co., 957 East Ferry St., Buffalo, $10,483. Grand total $44,095. **P.W.A.** Bids Oct. 2. Noted Sept. 26.

N. Y., Falconer—Ellicott Twp., Community Hall, extending c.i. mains in West Ellicott on 4 highways, by day labor. To exceed $12,000. Dpt. P. Wks., City Hall, Jamestown, in charge, L. F. Graham, city engr.

N. Y., Ovid—Village, extending 13,205 ft. 6 in. c.i. mains, and sixteen 6 in. hydrants, 4,557 cu.yd. excav., day labor, under supervision of J. Swan. $37,978. TERA project.

O., Fairport—J. Rendrick, mayor, waterworks, incl. submerged pipe line, to McLain Constr. Co., 162 Sanders Rd., Buffalo, N. Y., $33,104***elevated steel tank, to Chicago Bridge & Iron Wks., 654 Rockefeller Bldg., Cleveland, $17,720***water filtration plant, to Payne & Beymer, 32 North State St., Painesville, $68,750***land intake, to William Smith & Co., 82 Harmon Ave., Painesville, $11,183. Grand total $130,757. **P.W.A.** Bids Sept. 28, awarded Oct. 9. Noted Sept. 20.

O., Steubenville—City, installing water pump, to Dravo-Doyle Co., 300 Pennsylvania Ave., Pittsburgh, Pa., $6,847. **P.W.A.** Bids Aug. 31.

Okla., Wayne—City, waterworks, incl. well, pump, motor, watermains, elevated tank, valves and hydrants, to Fuller Constr. Co., Herskowitz Bldg., Oklahoma City, $26,211. Est. $32,000. **P.W.A.** Noted Apr. 19.

S. C., Blackville—Town Council, waterworks system, to Boyce & Co., Clearwater, Fla., $26,685. Est. $45,000. **P.W.A.** Bids Oct. 2. Noted Sept. 27.

S. D., Huron—City, steel standpipe for waterworks system, to Pittsburgh-Des Moines Steel Co., 1015 Tuttle St., Des Moines, Ia., $2,975*** 2 pumps, to Fairbanks Morse & Co., Park Square, St. Paul, Minn., $1,197 and $987 respectively***valves, to Ludlow Valve Co., Troy, N. Y., $1,985. Grand total $7,144. **P.W.A.** Bids Sept. 21.

Wis., Milwaukee—City, fill for water purification plant, to R. H. Gumz, 2065 South 18th St., $29,325. **P.W.A.** Bids Sept. 28. Noted Oct. 4.

Wash., Centralia—City, drilling 4 m.g. per day well, to N. C. Jannsen Co., 9107 East Marginal Way, $22,000.

SEWERAGE AND WASTE DISPOSAL

PROPOSED WORK

Ark., Stuttgart—City plans sanitary sewers. P.W.A. allotted $41,000 grant and loan. D. C. Wilcox, Stuttgart, engr. Noted July 19.

Calif., Carmel—Carmel Sanitary Dist. abandons proposal to construct sewage treatment plant and outfall line, also withdrew application for $22,000 P.W.A. grant. Noted Aug. 23.

Conn., Enfield—Town making plans trunk line sewer to accommodate 9 interceptor lines and construction of disposal plant, planned and approved by voters as FERA project. $350,000.

Ia., Sioux City—Plans constructing 9 blocks lateral riverfront sewer, eleminating open ditches carrying sewage from former river bank to new shoreline, $25,000. L. N. Hintgen, city engr.

Ia., Waverly—City making plans constructing sewage disposal plant. $90,000. H. R. Green Co., 208-10 Bever Bldg., Cedar Rapids, engrs. P.W.A. project. Noted Sept. 20.

Ia., West Bend—Citizens decided to petition Town Council to engage engineer to make survey for sewerage system.

N. Y., Greenburgh—Municipality soon takes bids sewerage system, $226,000. P.W.A. funds allotted. J. N. Heeney, 161 Main St., White Plains, engr.

N. Y., Honeoye Falls—Village soon takes bids sewage disposal system, $175,000. W. S. Lozier, Inc., 10 Gibbs St., Rochester, engrs. Noted Sept. 6.

N. Y., Schenectady—Dpt. Sanitation, Boro Hall, plans incinerator. $115,000 allotted by P.W.A. M. M. Cohen, Schenectady, engr. Noted Aug. 23.

O., Berea—City, received offer of Sanitation Engineers & Constructors, Inc., 247 Park Ave., New York, to build sewage disposal plant, trunk sewer and outlet to cost $205,000. Consumers to pay for same over a 20 year period when plant becomes property of owner. Owner will vote on ordinance on same, Oct. 15. P.W.A. project. R. F. MacDowell, Chester-Twelfth Bldg., Cleveland, engrs. Noted Jan. 11.

O., St. Clairsville—Village plans complete sewerage system. F.E.R.A. project. To exceed $22,000. Jennings & Lawrence, 12 North 3rd St., Columbus, engrs. Noted Aug. 3, 1933.

Okla., Clinton—City election Nov. 6, to vote bonds, sewage disposal plant. $41,000. C. P. Smith, Fort Worth, Tex., engr.

†Oregon—Bureau Reclamation, Ontario, soon takes bids 4 mi. welded clay steel, or precast concrete pipe for Malheur River and Dead Ox Syphons.

Tex., Monahans—City plans submitted for approval for complete sewerage system, lift station and sewerage pump, manholes, flush tanks, 2 sewerage pumps 600 g.p.m. capacity, 26,600 ft. 4 and 6 in. vitr. clay pipe. $34,000. F. Tatom, mayor, Koch & Fowler, 801 Central Bank Bldg., Dallas, engrs. Noted June 14.

Ont., Kitchener—Council making plans constructing storm sewer in West Ward. $30,000-$35,000. S. Shupe, City Hall, engr. Noted Oct. 4.

Ont., St. Catharines—Council making plans extending sewage disposal system, $150,000; widening York St., $28,000. B. A. Lamson, city engr.

Ont., Welland—Council plans relief program constructing additional sewers, roads and sidewalk, $35,000. C. L. Coulson, city engr.

BIDS ASKED

Conn., Stafford Springs—See "Contracts Awarded."

†Md., Beltsville—Oct. 30, by Dpt. Agriculture, Purchase, Sales & Traffic, Wash., D. C., constructing sewerage system, incl. 12 in. and smaller vitr. tile sewers, manholes, covers, automatic pumping station, excavation, at Beltsville Research Center.

N. Y., Long Island City—Oct. 23, by J. J. Halleran, acting pres. Queens Boro, Queens Subway Bldg., storm sewer in 197th St., 90th and Woodhull Aves.

N. Y., New York—Oct. 31, by S. Levy, pres. Manhattan Boro, Municipal Bldg., sewer changes at Canal, West and Marginal Sts., in connection with Dock Dpt. improvement at New Pier 32. Federal P. Wks. Project 2756.

Okla., Bartlesville—Oct. 29, by City, R. Taylor, mgr., sewage disposal plant. $138,000. P.W.A. project. Black & Veatch, 405 East 13th St., Kansas City, Mo., engrs. Noted Dec. 31.

Pennsylvania—See "Contracts Awarded."

Pa., South Williamsport—See "Contracts Awarded."

R. I., Providence—City, F. Nolan, eng., City Hall, bids about Oct. 28, Contr. 4, furnishing pumps, motors and other equipment in connection with sewage disposal plant addition at Field's Point. P.W.A. project.

Tex., Fairfield—Oct. 29, by City, H. L. Williford, mayor, 4½ mi. 12- to 24-in. vitr. clay sanitary sewers, disposal plant. $85,000. P.W.A. project. H. H. McAllister, 914 Washington St., Waco, and H. R. S. Helland, Frost Bldg., San Antonio, engrs. Noted Sept. 27.

Vt., St. Albans—Oct. 25, by City, B. M. Hopkins, clk., City Hall, sewage disposal system, sedimentation, several periods of aeration, and fall sewer to Stevens Brook, approximately 17,000 ft. Original est. $90,000. P.W.A. grant of $24,000. H. W. Taylor, 11 Park Pl., New York, engr.

CONTRACTS AWARDED

Calif., Colton—City Council, sewage filtration plant, to Myers Bros., 3407 San Fernando Rd., Los Angeles, $37,164. **P.W.A.** Bids Sept. 11. Noted Sept. 20.

Calif., Los Angeles—City, A. J. Holm, purch. agt., City Hall, furnishing, installing welded steel pipe baffles and supports and special gate valves in connection with disposal plant at Hyperion Sewage Screening Plant, Informal Bid 845, to Snow Mfg. Co., 2437 East 24th St., $1,993.

Conn., Stafford Springs—Town, constructing rein.-con. sewage treatment tanks, structure field stone and rein.-con., 30x40 ft., also sewer lines, with F.E.R.A. labor. $88,000. Noted May 3.

Ia., Cedar Rapids—City, gas engine generator for sewage disposal plant, Sect. G, to Iowa Mfg. Co., Cedar Rapids, $26,900***vacuum sludge filter, Sect. H, to Iowa Mfg. Co., Cedar Rapids, $17,300***digester covers and gas holders, to Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill., $32,300. Grand total $76,500. **P.W.A.** Bids Aug. 24. Noted Aug. 2.

Ia., Corning—City Council, outfall sewer to Hoak Constr. Co., 1007 Hubbell Bldg., Des Moines, $32,000***sewage disposal plant, to Morr Co., Kansas City, Mo., $2,875***pump to Dayton-Dowd Co., Omaha, Neb., $1,020. Grand total $35,805. **P.W.A.** Bids Oct. 2. Noted Sept. 27 Daily.

Ia., Sioux City—City, sanitary sewers in various streets, to B. E. Short Co. and H. S. Holtze Co., 418 Court St., $6,495. Bids Sept. 7, sanitary and storm sewers in various streets, to Jensen & Krage, Sioux City, $27,173. Bids Sept. 14. **P.W.A.** L. Hintgen, City Hall, engr.

Mass., Boston—City, Dpt. P. Wks., C. J. Craven, comr., City Hall Annex, Hyde Park Branch of Oakland Brook Sewer in Royal, Raleigh, Ridgeston and Rutledge Rds., to C. Adreassi, N Gateland St., Jamaica Plain, $22,292. **P.W.A.** Bids Oct. 3. Noted Sept. 27.

N. D., Fargo—City, constructing sewage disposal plant and building overrock filter, to Meinecke-Johnson and T. F. Powers Constr. Co., Fargo, $308,630 and $48,265 respectively*** collector sewerage system, to J. A. Shaw and S. Birch & Sons Constr. Co., Fargo, $305,991. Grand total $662,886. **P.W.A.** Bids Sept. 27. Noted Sept. 20.

O., Portsmouth—F. E. Sheehan, city mgr., sewerage system, Contrs. 1, 2 and 3, to Frowine Bros., 821 Prospect St., Portsmouth, $6,803*** Contrs. 4 and 5, to B. F. Perry, 106 Main St., Akron, $27,959 and $30,145 respectively. Grand total $64,907. **P.W.A.** Bids Aug. 7. Noted Aug. 9.

O. Van Wert—B. A. Welch, dir. P. Wks., Contr. 1, sewage treatment plant, 10,931 ft. 8- to 36-in. vitr. clay and 2,778 ft. 16 in. cl. force mains, to Gallagher & Burk Constr. Co., 19940 Roslyn Ave., Rocky Creek, $56,712. **P.W.A.** Bids Aug. 29.

Pennsylvania—Clarion Co. and Borough-Clarion, constructing sewers in Knox, $17,420; street construction in Clarion, $5,278; sewer in Fryburg, $629; grading in Farmington, $3,480; street construction in Curllsville, $3,971; road construction in Perry Twp., $8,513, day labor. Grand total $39,351. E. E. Slicker, dir. Wks. Div. Clarion, engr.

Pa., South Williamsport—Borough, installing 17,255 lin.ft. new sanitary sewers in Mountain Ave., Market, Winthrop, Clark Hill, Howard, Lowe and Baynard Sts. R.W.D. project, under direction R. Lehman, dir. R.W.D. and Boro Eng. Dpt., Williamsport, by day labor. To exceed $22,000.

Tex., Houston—City, O. F. Holcombe, mayor, and City Council, 42 in. sanitary outfall relief line sewer from Willow St. to pumping plant, to Northside Disposal Plant to Russ Mitchell, Inc., 2701 Texas Ave., $156,564. **P.W.A.** Bids Sept. 26. Noted Sept. 20.

Va., Clarendon—Arlington Co., 40,000 ft. 8 in. and 1,200 ft. 12 in. sewer, Contr. 9, to American Impvt. Co., Chicago, Ill., $82,000***4,200 ft. 33 in., 15,000 ft. 36 in., 1,260 ft. 42 in., Contr. 10, to Artino Co., Cleveland, O., $110,000 ***400 ft. 33 in. in open cut, 3,700 ft. 33 in. in tunnel, 500 ft. shafts, Contr. 11, to Square Constr. Co., Society for Savings Bldg., Cleveland, O., $120,000***76,300 ft. 8 in., 3,300 ft. 10 in., 4,400 ft. 12 in., 2,450 ft. 15 in., and 5,700 ft. 18 in., Contr. 12, to Nolan Constr. Co., Detroit, Mich., $182,000. Grand total $494,000. **P.W.A.** Bids Sept. 28. Noted Sept. 13.

†*Federal Government.*

Low Bidders for the Colorado River Aqueduct

Metropolitan Water District, Los Angeles, Calif., opened bids Oct. 11, for construction of 110.62 mi. of cut and cover concrete-lined canal, monolithic and precast siphons, steelpipe siphons and appurtenant work on the Colorado River Aqueduct. Extended totals for Schedules and Combinations of Schedules for apparent low bidders, as follows:

Contractors	Schedules	Totals
C. W. Wood and M. J. De Vanda, Stockton, Calif.	3 + 3A + 3B	$965,225
Thompson-Starrett Co., 444 Madison Ave., New York	14 + 14A	926,961
	15 + 15B + 15A	1,058,047
	16 + 16B + 16A	814,910
Jahn & Bresse Constr. Co., Lane Mtg. Bldg., Los Angeles	5 + 5A	713,007
Mittry Bros. Constr. Co., 5531 Downey Rd., Los Angeles	2 + 2A + 2P	1,399,982
	4 + 4A	682,831
Hanrahan Co., & Youdall Constr. Co., San Francisco, Elliott Stroud Bros. & Seabrook, 1212 Ethel St., Glendale, and Chas. Harlow, Jr., and C. M. Elliott (combined bid)	1 + 1A + 1B	1,036,774
	2 + 2A + 2B	1,146,407
	6	390,302
	8 + 8A + 8B	777,830
	10 + 10A + 10B	819,505
	11 + 11A + 11B + 11C	875,227
	13 + 13A + 13B	629,414
Three Companies, Inc., Denver, Colo.	12 + 12A	1,313,272
	12 + 12S	1,353,489
United Concrete Pipe Co., 1347 West 208th St., Los Angeles	6P (alt. to 6)	643,832
Griffith Co., 502 Los Angeles Rwy. Bldg., Los Angeles	14 + 14P	1,178,461
Hunkin-Conkey Constr. Co., Cleveland, O.	15 + 15B + 15P	1,281,857
Barrett & Hilp, 918 Harrison St., San Francisco, and Macco Constr. Co., Clearwater, Calif.	3 + 3A + 3P	1,275,186
	8 + 8A + 8P	1,135,958
	11 + 11A + 11B + 11P	1,157,467
Utah Constr. Co., 1 Montgomery St., San Francisco, Calif.	9 + 9A + 9B + 9C	955,249

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sewerage, etc. (Continued)

Wis., Racine—P. Wks., constructing shore protection and effluent line at sewage plant, to E. E. Gillen, 626 East Wisconsin Ave., Milwaukee, $151,827. P.W.A. Bids Sept. 27.

BRIDGES AND GRADE CROSSINGS

PROPOSED WORK

Calif., Los Angeles—See "Commercial Buildings."

BIDS ASKED

Connecticut—See "Streets and Roads."

Iowa—Oct. 23, by State Hy. Comn., Ames, 2 metal pipe, 3 concrete pipe and 3 box culverts on Secondary Rd., south of Stuart, NRS 460-C, Adair Co.; 7 box and 2 corrugated metal culverts and extension bridges on Secondary Rd., southeast of Exira, NRS 478-B, Audubon Co.; 9 pipe and 4 box culverts, bridges, on Primary Rd. 73, NRH 247-C, Cherokee Co.; 8 concrete pipe and 15 box culverts, Primary Rd. 112, NRH-NRM 495-AB, Clayton Co.; 2 box, 5 concrete pipe and 2 pipe culverts bridges on Secondary Rd., NRS 477-B, Decatur Co.; 3 concrete pipe and relaying 1 old corrugated metal pipe culverts on Secondary Rd., NRS 513-A, Fremont Co.; 6 concrete pipe and 37 box culverts, Primary Rd. 183, NRH 356-B, Harrison Co.; 7 concrete pipe, 4 corrugated pipe and 10 box culverts, bridges on County Trunk Q, NRS 516-AB, Madison Co.; 15 concrete pipe and 2 metal pipe culverts on Secondary Rd., NRS 488-B, Mills Co.; creosoted wood box culvert on Primary Rd. 165, B-787, Monona Co.; culvert on Primary Rd. 10, B-69, O'Brien Co.; 5 corrugated metal pipe culverts on Secondary Rd., NRS 518, Page Co.; bridge on Rds. 34 and 275, southeast of Council Bluffs, Pottawatamie Co.; 15 concrete pipe and 17 box culverts on Primary Rd. 25, NRS 451, Ringgold and Taylor Counties; box culvert on Rd. 30, FAB-276, Tama Co.; 5 corrugated metal pipe and 13 box culverts on Secondary Rd., from Sharpsburg East, NRS 486-B; bridge on Secondary Rd., NRS 486C, both Taylor Co.; 2 concrete pipe and 8 box culverts on Secondary Rd., NRS 485; 15 concrete pipe and 9 box culverts on Secondary Rd. between Humestone and Cambria, NRS 500, both Wayne Co.; bridge on Primary Rds. 10 and 60, NRH 29-1, Wright Co.; 4,700 ft. single cable guard rail Primary Rd. 90, F-340, Polk and Dallas Counties. F. R. White, state hy. engr.

Kentucky—See "Streets and Roads."

Massachusetts—Oct. 30, by Commonwealth of Massachusetts, Dpt. P. Wks., F. E. Lyman, comr., 100 Nashua St., Boston, rein.-con. pile bridge, 627 ft. total span, involving 3,390 sq. yd. bituminous concrete surfacing on bridge and approaches over Bass River, between Dennis and Yarmouth. Fay, Spofford & Thorndike, 44 School St., Boston, engrs.

Ohio—Oct. 26, by O. W. Merrell, dir. Hys., Columbus, reconstructing 5 span, wood, steel bridge, by removal of 3 wood truss spans and substituting 3 steel calem-back truss spans, and constructing new backwalls, capping 1 abutment, 3 piers and build 1 new pier and new realigned bridge to consist of Span "A" 153 ft., Span "B" 148.73-4 ft., Span "C" 146.7 ft., Span "D" 165.7 ft. and Span "E" 165.7 ft., with 14 ft. 8 in. roadway, on Sect. "A" Waverly-Zohn's Corners Rd., Pike Co., $50,465.

Virginia—See "Streets and Roads"

Wisconsin—Oct. 30, by State Hy. and Winnebago Co. Hy. Comns., Madison, constructing one 45 ft. I-beam bridge and one 26 ft. submerged concrete deck girder bridge, State Trunk Hy. 125, State Project 3510, Neenah-Appleton Rd.; culverts and small bridges, S.T. Hy. 125, Project 3510, Neenah-Appleton Rd., both Winnebago Co.; overhead structure, Madison-Dodgeville Rd. (Blue Mounds Mount Horeb), U. S. Hy. 18, Dane Co.

CONTRACTS AWARDED

Indiana—State Hy. Comn., Indianapolis, rein.-con. arch bridge in Allen Co., to C. R. Wermuth, 512 East Suttenfield St., Fort Wayne, $63,924. Est. $73,388. Bids Sept. 18. Noted Sept. 13.

Iowa—State Hy. Comn., Ames, 19 concrete pipe culverts, extensions NRS 436, in Black Hawk Co., to E. B. Spencer Constr. Co., Waterloo, 2,850***13 box culverts, extensions, on same road, to W. A. Burton, Waterloo, $6,112 ***two 32x20 ft. skew I-beam bridges on same road, to A. Olson, Waterloo, $10,904***bridge in Butler Co., to A. M. Cohron & Bros., Des Moines, $25,393. Grand total $45,265. P.W.A. Bids Sept. 25. Noted Sept. 20.

Kentucky—State Hy. Comn., Frankfort, substructure and earth approaches for bridge over Dix River, and 0.78 mi. approaches, NRH 276-A1BG, Boyle and Garrard Counties, to Shields Constr. Co., $42,281; one 150 ft. deck truss and five 60 ft. I-beam span superstructure for above bridge, to Vincennes Bridge Co., Vincennes, Ind., $38,381. P.W.A. Bids Sept. 21, awarded Sept. 25. Noted Sept. 6, under "Streets and Roads."

Maryland—State Rds. Comn., Baltimore, triple span steel girder bridge with concrete floor, substructure, etc., Contr. B-316-2-48, Federal Aid Project NRH 335C, Baltimore Co., to Northeastern Constr. Co., 6 West Madison St., Baltimore, $96,705***single span steel truss bridge with concrete floor and substructure, Contr. AA-172-2-79, P-293-2-79, Federal Aid Project NRS 339 B (1935) Anne Arundel and Prince George Counties, to Maryland Eng. Constr. Co., 3945 Greenmount Ave., Baltimore, $50,215*** single span iron plate arch bridge Contr. M-275-2-35, Montgomery Co., to Pfoffenberger & Maus, Meyersville, $3,665. Grand total $150,585. P.W.A. Bids Oct. 17.

†**Md., Annapolis**—Yards & Docks, Navy Dpt., Wash., D. C., foot bridge and pile dolphins, to Merritt Chapman & Scott, Fidelity Bldg., Baltimore, $1,917. Bids Sept. 26.

Massachusetts—Commonwealth of Massachusetts, Dpt. P. Wks., Boston, electrical equipment and wiring of New Fore River bridge between Quincy and Weymouth, to Alfred J. Hixon Co., South Boston, approximately $50,000. Noted Mar. 15, under "Contracts Awarded."

Mass., Lawrence—Comrs. Essex Co., Court House, Salem, superstructure of Falls Bridge over Merrimack River, to Central Constr. Co., 316 Essex St., $173,900. Bids Sept. 25. Noted Sept. 20.

Missouri — State Hy. Dpt., Jefferson City, bridges over Sand Creek, Nodaway Co., to O. H. Schmidt, Inc., St. Joseph***over Bear Creek, Marion Co., to Lay Constr. Co. and Powers-Thompson Co., North Kansas City***over railroad and over Big Blue River, Jackson Co., to M. E. Gilhoz, Monett***over Sam Creek, St. Charles Co., to F. T. O'Dell Constr. Co., Hannibal***over Castile Creek, Clinton Co., to Snyder & Johnson, Inc., Humboldt, Ia.***over drainage ditch, Perry Co., to Kiefner & Guile Constr. Co., Perryville***over Shoal Creek, Livingston Co., to C. H. Atkinson Paving Co., Chillicothe***over Cane Creek Overflow and over Cane Creek, Butler Co., to Service Constr. Co., Polar Bluff***over Lost Creek and Cedar Creek, Washington Co.; over Caples Creek and over Dillon Creek, Andraw Co., to Lay Constr. Co., North Kansas City ***over Turkey Creek, Jasper Co., and over Eleven Point River, Oregon Co., to Kelly & Underwood, Granby***over Doolittle Creek and over Roubidoux Creek, both Texas Co.; over Branch and over Hawkins Branch, both Howell Co., to Carte Harlin Constr. Co., West Plains*** over Little Tarkio Creek, Atchison Co., over Spring Creek, Ozark Co., over Little River Drainage Ditch 251, New Madrid Co., and over fork Platte River, Buchanan Co., to Condon, Cunningham & Lemmon, Kirkwood. Estimated cost $576,400. P.W.A. Bids Sept. 28. Noted Sept. 20.

New Mexico—State Hy. Dpt., Sante Fe, constructing Chama River Bridge, Rio Arriba Co., to Wheeler, Carrico & Silver, Albuquerque, $12,051 est. $12,800***bridge in Mora Co., to Kirchhof Hanes, Inc., Denver and Albuquerque, $129,364 est. $154,926. P.W.A. Bids Oct. 11. Noted Oct. 4.

New York—A. W. Brandt, comr. Hys., Albany, bridge in Delaware Co., to Peckham Road Corp., White Plains, $7,088 est. $7,052*** Nassau Co., to Good Roads Eng. & Contg. Co., Inc., Wantaugh, $137,562 est. $163,730*** Jefferson Co., to Black Top Paving Co., Inc., Watertown, $12,300 est. $14,841***Orange Co., to Manstin Eng. Corp., Napanoch, $88,572 est. $115,140***Jefferson Co., to L. J. Gates, Cape Vincent, $42,870 est. $49,844***Greene Co., to W. Van Kleeck, New Paltz, $64,662 est. $79,259***Erie Co., to J. Tata, Buffalo, $38,494 est. $44,243***widening bridge, Ontario Co., to M. E. Colle, Inc., Le Roy, $7,386 est. $7,836. Grand total $398,934. P.W.A. Bids Sept. 11 and 25, Oct. 2 and 9. Noted Aug. 30, Sept. 13 and 27, under "Streets and Roads."

South Dakota—State Hy. Comn., Pierre, to Dowd Bros., Inc., Clark, Bridges in Codington Co., $1,514***to F. I. Cummins Constr. Co., Sioux Falls, in Edmunds Co., $7,822***to Graves Constr. Co., Melvin, Ia., in Campbell Co., $4,936***to W. H. Pringle, Pierre, guard rail in Codington Co., $506; in Custer Co., $2,552; in Gregory Co., $240; in Tripp Co., $3,345; in Butte Co., $3,151; in Codington Co., $230***to W. R. Lindekugel, Spencer, in Hanson Co., $380; in Davison Co., $722; in Turner Co., $421; in Davison Co., $247; in Turner Co., $268. Grand total $28,334. Bids Oct. 10. Noted Oct. 4.

†**Wyoming**—Pub. Rds., Denver, Colo., constructing 3 bridges, approaches on Tower Junction-Cooke City Hy., Yellowstone Nat'l. Park, to Strong & Grant, Springville, $68,838. Bids, Sept. 18.

Ontario—See "Streets and Roads."

STREETS AND ROADS

BIDS ASKED

Arizona — Oct. 30, by State Hy. Comn., Phoenix, grading, draining 9 mi. Kingman-Boulder Dam Hy., N.R.S. 102-B, A.F.E. 6903, T. S. O'Connell, state hy. engr.

Connecticut—Oct. 22, by J. A. Macdonald, state hy. comr., Hartford, bituminous macadam on broken stone paving 28,472 ft. hy. Madison and Killingworth, NRH 5% B, U.S.P.W. Project; 1,550 ft. concrete paving, 60 ft. span rigid frame bridge Greenwich, Docket 5145-2 and 24 in. bituminous on 6 in. broken stone paving 36,578 ft. hy. Meriden and Berlin, both P.W.A. projects; rein.-con paving 1,843 ft. and 3 in. bituminous macadam on 4 in. broken stone paving 839 ft. hy. New London, Docket 6063, P.W.A. project; 64 ft. span stone faced triple arch bridge over Wopowaug River, Milford; 3 in. sheet asphalt on concrete paving 5,013 ft. hy. Norwalk; 24 in. bituminous macadam on 6 in. broken stone paving 1,325 ft. Stafford; extending 12 ft. span concrete slab bridge on Route 6, Woodbury, foregoing trunk line projects; trap rock waterbound macadam paving 6,800 ft. Granville Rd., Hartland; 3,897 ft. Bartlett St., Portland, both state aid projects; 272 ft. rein.-con. and 521 ft. bituminous macadam paving Brownstone Ave., Portland, town aid project.

Idaho—Oct. 26, by G. E. McKelvey, comr. P. Wks., grading, crushed rock surfacing 8.428 mi. Cassia Hy., Cassia Co., incl. 98,000 cu.yd. unclassified and 1,200 cu.yd. structural excav.; grading, crushed rock surfacing 5.966 mi. Lewis and Clark Hy., Nez Perce Co., 181,000 cu.yd. solid rock, 141,610 cu.yd. common and 1,100 cu.yd. structure excav.

Ill., East Alton—Oct. 24, by Bd. Village Trustees, C. A. Vanpreter, pres., paving, $72,500. P.W.A. project. Sheppard, Morgan & Schwaab, Faulstick Bldg., Alton, engrs.

Ill., Geneva—Oct. 24, by Dpt. P. Wks. & Buildings, Div. Hys., concrete paving 1.3441 mi. Sect. 104-15d, Kane Co., 20 ft. G. H. Baker, engr. co. roads and city streets.

Iowa—Oct. 23, by State Hy. Comn., Ames, paving 0.356 mi. Primary Rd. 1, south of Fairfield, NRH 120-E, Jefferson Co.; 0.85 mi. U. S. Rd. 6, Council Bluffs, NRM 310-E, Pottawattamie Co.; grading 3.483 mi. Secondary Rd. from Stuart South, NRS 46-BC, Adair Co., incl. 32,263 cu.yd. excav.; 1.924 mi. Secondary Rd., southeast of Exira, NRS 478-B, Audubon Co., 42,865 cu.yd. excav.; 3.007 mi. Primary Rd. 73, out of Larrabee, NRH 247-C, Cherokee Co., 134,630 cu.yd. excav.; 5.001 mi. Primary Rd. 112, from Volga Southeast, NRH-NRM 495-AB, Clayton Co., 132,769 cu.yd. excav.; 2.011 mi. Secondary Rd., north of Sects. 23 and 24, NRS 477-B, Decatur Co., 31,080 cu.yd. excav.; 3.212 mi. Secondary Rd., from U. S. Rd. 275, northeast to Anderson, NRS 513-A, Fremont Co., 71,784 cu.yd. excav.; 5.389 mi. Primary Rd. 183, NRH 356-B, Harrison Co., 203,195 cu.yd. excav.; 4.118 mi. County Trunk Rd. Q, NRS 516-AB, Madison Co., 122,918 cu.yd. excav.; 7.244 mi. Secondary Rd., NRS 448-B, Mills Co., 123,666 cu.yd. excav.; 3.865 mi. Secondary Rd., NRS 518-A, Page Co., 67,529 cu.yd. excav.; 6.748 mi. Primary Rd. 25, NRS 451-C, Ringgold and Taylor Counties, 163,076 cu.yd. excav.; 4.065 mi. Secondary Rd. from Sharpsburg, NRS 486-B, Taylor Co., 96,010 cu.yd. excav.; 1.426 mi. Secondary Rd. from southeast corner Sect. 22, NRS 485, Wayne Co., 38,251 cu.yd. excav.; 5.987 mi. Secondary Rd., NRS 500-A, Wayne Co., 66,097 cu.yd. excav.; graveling or crushed stone surfacing 12.626 mi. Secondary Rd. from Stuart south to Primary Rd. 2, NRS 460-ABC; 11.777 mi. Secondary Rd., north and south of Fontanelle, NRS 462-AB, both Adair Co.; 6.989 mi. NRS 432-AB, Primary Rd. 190, Buchanan and Fayette Counties; 7.205 mi. Secondary Rd. from Randolph to Imogene, NRS 509-Fremont Co.; 4.871 mi. Secondary Rd., NRS 505, Iowa Co.; 10.725 mi. Primary Rd. 25, F-383, Ringgold and Taylor Counties. F. R. White, state hy. engr.

Kansas—Oct. 23, by State Hy. Comn., Salina, (**P. means Project**) earthwork, culverts, roadside improvement 2.447 mi. P. 81-16 NRH 44 ABE (1935) Salina Co.; 10.651 mi. P. 14-19 NRH 467 A (1935) Mitchell Co.; sand gravel surfacing 4.997 mi. P. 18-12 NRS 481 A (1935) and 6.924 mi. Project 18-12 NRS 481-B (1935) both Ottawa Co.; 7.011 mi. P. 9-13 NRH 442 B (1935) Cloud Co.; 55 ft.-65 ft. continuous I-beam span bridge over Monkers Creek, P. 13-07 NRH 363 E (1935) Morris Co.

Kansas—Oct. 26, by State Hy. Comn., at office County Clerk, Wichita, earthwork, culverts, roadside improvement, bridging, bituminous filled brick paving, concrete paving, modified sheet asphalt surfacing, asphalt paving, 21.015 mi. hys. in Barton, Edwards, and Sedgwick Counties.

Kansas—Oct. 27, by State Hy. Comn., at office of County Clerk, Iola, concrete paving, roadside improvement, earthwork and culverts, bridging 7.835 mi. hys. in Labette, Wilson, Montgomery, Miami, Elk and Allen Counties.

Montana — Oct. 25, by State Hy. Comn., Helena, improving roads in Carbon, Lincoln, Blaine, Phillips, McCone, Dawson, Golden Valley, Musselshell, Beaverhead, Richland and Gallatin Counties. R. D. Rader, state hy. engr.

†**Mississippi**—Oct. 30, by Pub. Rds., Dpt. Agriculture, at office Park Superintendent, Vicksburg, grading, graveling, rein.-con. paving 12,400 sq.yd. road Project 1B1-5A1, Vicksburg Military Park, incl. 40,700 cu.yd. excav. H. J. Spelman, principal engr.

New Hampshire—Oct. 25, by State Hy. Dpt., Concord, gravel surfacing 0.626 mi. hy. from Errol to Upton, Me., Cambridge, Coos Co., involving 4,632 cu.yd. earth and 2,263 cu.yd. rock excav., $16,000; 1.416 mi. Central Rd., Northwood, Rockingham Co., 41,031 cu.yd. earth and 4,400 cu.yd. ledge excav., $55,000; 1.024 mi. Westmoreland-Chesterfield Rd., Westmoreland and Chesterfield, Cheshire Co., 8,841 cu.yd. earth and 913 cu.yd. rock excav., $17,000. P.W.A. project. C. P. Riford, Concord, engr.

N. Y., Brooklyn—Oct. 25, by R. V. Ingersoll, pres. Brooklyn Boro. Boro Hall, grading, asphalt on concrete repaving Troy Ave., 46th, East 32nd and East 18th Sts.; grading East 64th St.

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†*Federal Government.*

Streets and Roads (Continued)

N. Y., Niagara Falls—See "Contracts Awarded."

Pennsylvania—Oct. 26, at office S. S. Lewis, secy. Hys., Harrisburg, dual type paving 12,493 ft. R-157, Sect. 7, Richmond and Maxatawny Twps., Berks Co., involving 18,093 cu.yd. Class 1, 5,212 cu.yd. Class 2 and 2,594 cu.yd. borrow excav.; rein.-con. paving 515 ft. R-06113, Sect. 1, Reading, Berks Co., 2,300 cu.yd. Class 1 excav.; grading, drainage, rein.-con. arch., 2,902 ft. R-29, Sect. 2, Potter Twp., Centre Co., 58,014 cu.yd. Class 1 and 362 cu.yd. Class 2 excav.; bituminous on plain concrete surfacing 3,257 ft. R-180, Sect. 2, city of Chester, Delaware Co.; rein.-con. paving, grading approach 15,655 ft. R-50, Sect. 2, Wharton Twp., Fayette Co., 103,347 cu.yd. Class 1, 2,608 cu.yd. Class 2, and 343 cu.yd. borrow excav.; rein.-con. paving 12,100 ft. R-166, Sect. 7, city of Easton Forks Twp., Northampton Co., 36,951 cu.yd. Class 1, 1,542 cu.yd. Class 2, and 7,481 cu.yd. borrow excav.; rein.-con. paving, bituminous surface course, Spec. E material, 8,972 ft. R-166, Sect. 7A, Forks Twp., Northampton Co., 14,626 cu. yd. Class 1, 1,643 cu.yd. Class 2 and 140 cu.yd. borrow excav.; rein.-con. paving, rein.-con. wearing surface for bridge floor, 6,850 ft. R-1, Lower Mahanoy Twp., Northumberland Co., 11,101 cu.yd. Class 1 and 70 cu.yd. Class 2 excav.; rein.-con. paving, bituminous approach, 6,050 ft. R-49, Sect. 2, Allegheny, Stony Creek and Brothers Valley Twps., Somerset Co., 21,299 cu.yd. Class 1 and 763 cu.yd. Class 2 excav.

Tennessee—Oct. 26, by Tennessee Dpt. Hys. and P.W., Memorial Bldg., Nashville, grading, drainage, paving 0.58 mi. State Hy. 6, Project NRM 206, Parts 1 and 2 (1935) Davidson Co.; grading, drainage, constructing 2 bridges 0.83 mi. NRS 274-B (1935) Henry Co.; grading, drainage 1.306 mi. State Hy. 13, NRS 286-B, Perry Co.; 2.726 mi. State Hy. 82, NRS 411-B (1935) Bedford Co.; paving 5.473 mi. State Hy. 78, NRS 413-A (1935) Lake Co.

†**Tennessee**—Nov. 1, at office Acting Superintendent Meriwether Lewis Natl. Monument, on Route 20, about 5 mi. east of Hohenwald, Lewis Co., grading, surfacing 1.17 mi. roads in Meriwether Lewis Natl. Park, Project 1A1, incl. 27,500 cu.yd. unclassified excav. H. J. Spelman, principal hy. engr.

Tex., Houston—City soon takes bids shell and gravel paving White Oak Dr. from north end of Milan St. underpass to east line of Acuff St. $24,700. J. M. Nagle, dir. P. Wks.

Virginia—Oct. 23, by Dpt. Hys., Richmond, macadam paving 0.82 mi, Route 11, State Project NRH-589D2, Federal Project NRH-339B, U2-NRM 339B, U2, Shenandoah Co.; paving Route 168, NRS 599A3C1, Federal Project NRS 417C, Warwick Co.; Routes 2 and 3, NRM-1040-CDE, Federal Project NRM-318-B-408-FG, Fredericksburg Co.; macadam paving 1 mi. and constructing 2 bridges Route 501, State Project NRM-1032-CDEB1, 2 NRM-48-HG, Lynchburg; constructing 174 ft. Nansemond River Bridge, Route 460, State Project NRH-M-333B 2H-B2M, Federal Project NRH-M-307-E, Suffolk Co.; 144 ft. overhead, Route 1, State Project NRM1033B2, Federal Project NRM40 U2; 112 ft. bridge State Project NRM 1033B1 HBIM, Federal Project NRM 40 NRH 40, U4, both Dinwiddie Co.

Wash., Okanogan—Oct. 30, by Comrs, Okanogan Co., grading, crushed stone surfacing 5,132 cu.yd. Tonasket-Melsen Rd., incl. 26,746 cu.yd. Class A, and 1,768 cu.yd. solid rock excav. M. P. McCoy, Okanogan, engr.

CONTRACTS AWARDED

Alabama—State Hy. Dpt., Montgomery, concrete paving 3.15 mi. Florence-Tennessee State Line Rd., Lauderdale Co., to Hardaway Constr. Co., Columbus, $72,910***seal coat surfacing 14.19 mi. Birmingham-Leeds Hy., Jefferson Co., to Inter-State Constr. Co., Independent Life Bldg., Nashville, Tenn., $33,800***grading, drainage, graveling 5.17 mi. Roanoke-Wadley Rd., Randolph Co., to Beckham-Lawler and W. C. Shepard, 347 Elizabeth St., N.W., Atlanta, Ga., $43,005***bridges on same road, to J. S. Walton, Mobile, $23,984. Grand total $183,699. **P.W.A.**

Arizona—State Hy. Comn., Phoenix, grading, draining 4 mi. Globe-Showlow Hy., to G. W. Orr, El Paso, Tex., $316,938***base course surfacing, constructing shoulders and stockpile aggregate on 64 mi. Holbrook-Lupton Rd., to Tanner & Hall Co., 525 Title & Trust Bldg., Phoenix, $40,422. **P.W.A.** Bids Sept. 25. Noted Sept. 13.

California—State Hy. Comn., State Bldg., Los Angeles, grading, asphaltic concrete paving 0.6 mi. hy. between west city limits and Beverly Blvd., Los Angeles Co., to Los Angeles Paving Co. Inc., 3200 East Vernon Ave., Los Angeles, $77,241; grading, fuel oil treating and bituminous surface treating 6.6 mi. hy. between point 5¼ mi. east of Llano and Camp Cajon, Los Angeles and San Bernardino Counties, to Herz & Co., Platt Bldg., San Bernardino, $24,799. Bids Sept. 27, awarded Oct. 3. Noted Sept. 13.

California—State Hy. Comn., Sacramento, removing 0.3 mi. slides on hy. between Greenbrae and Alco, Marin Co., incl. 125,000 cu.yd. excav., 50,000 yds. overhaul, to Union Paving Co., Call Bldg., San Francisco, $29,750. Bids Oct. 3, awarded Oct. 8.

Colorado—State Hy. Dpt., Denver, concrete paving 5.183 mi. hy. at Iliff and west of Iliff,

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on State Hy. 2, NRM 175-A, Div. 3, and 175, Div. 4 (1935), Logan Co., to J. B. Bertrand, 1900 Monoca Blvd., Denver, $110,767. **P.W.A.** Bids Oct. 1, awarded Oct. 6.

†**Colorado**—Pub. Rds., Denver, grading 4.967 mi. road in Gilpin Co., to W. A. Colt & Son, Lyons, $80,339. Bids Sept. 18. Noted Sept. 11.

†**D. C., Wash.**—Treas. Dpt. at office Sup. Archt., Wash., D. C., grading, walls, sprinkler system, top soil, etc., for Triangle Area, to Easthom Melvin Co., Woodward Bldg., $130,500.

Illinois—Dpt. P. Wks. & Buildings, Div. Hys., Springfield, concrete paving 0.99 mi. road in Perry Co., 18 and 20 ft., to Mautz & Oren, Inc., Effingham, $35,216. Bids Sept. 20. Noted Sept. 13.

Indiana—State Hy. Comn., Indianapolis, bituminous macadam paving 4.4 mi. Hamilton Co., to H. A. Carpenter, Brazil, $19,831***4.2 mi. Clay and Owen Counties, to L. P. Cavett Co., Lockland, O., $21,925***6.7 mi. Rush Co., to Road Resurfacing Co., Bloomington, $26,752 ***7.2 mi. Fountain Co., to Brooks Constr. Co., 1134 Barthold St., Fort Wayne, $28,314***8.3 mi. Henry Co., to W. J. Nees & Co., Mishawaka, $25,547***bitum. mulch, liquid asphalt surfacing 7.921 mi. Floyd Co., to Ralph Myers, Campbellsburg, $53,639. Grand total $176,008.

Indiana—State Hy. Comn., Indianapolis, concrete paving 55,163 sq.yd. Rds. 37 and 54, in Lawrence Co., to Calumet Paving Co., Gary, $239,049. Est. $276,376. Bids Sept. 18.

Ind., Rockville—Parke Co., liquid asphalt resurfacing highways, to J. R. Walsh, Terre Haute, $22,489. Est. $25,000. C. V. Lamb, Rockville, aud.

Iowa—State Hy. Comn., Ames, to Kelly Constr. Co., Des Moines, frost boil treating 7.5 mi. Grundy Co., $6,618***to E. C. Schroeder, McGregor, 11.4 mi. Butler Co., $8,978***to Falk & Litzelman, St. Ausgar, 10.1 mi. Floyd Co., $9,563***to Cremer Constr. Co., Decorah, 8.2 mi. Allamakee Co., $5,160***to M. O. Weaver, Des Moines, 20.5 mi. Jackson Co., $7,154***to S. P. Moore, Cedar Rapids, 13.2 mi. Iowa Co., $6,137; 23.1 mi. Johnson Co., $4,782; 22.6 mi. Delaware Co., $9,224***to J. A. Huff, Armstrong, 10.1 mi. Dickinson Co., $955***to Hartsell & Evans, Early, 8.5 mi. O'Brien Co., $1,979; 7.8 mi. Sioux Co., $1,002. Grand total $61,552. Bids Oct. 9. Noted Oct. 4.

Kentucky—State Hy. Comn., Frankfort, traffic bound macadam paving, grading, drainage, 8.104 mi. Peonia-Munfordville Rd., S.P. 617 CS, Grayson Co., to Highland Co. Inc., 1 Baxter Ave., Louisville, $26,284***traffic bound macadam surface treating 7.336 mi. Falls of Rough-McDaniels Rd., S.P. 12-AC-S, Grayson and Breckinridge Counties, to H. Rogers & Co., Bloomington, Ind., $24,500***grading, draining 4.019 mi. Nortonville-Greenville Rd., FR 24 AG, Hopkins Co., to Ellis, Kelly & Co., Owensboro, $54,270. Grand total $105,054. **P.W.A.** Bids Sept. 21, awarded Sept. 25. Noted Sept. 6.

Maine—State Hy. Comn., L. D. Barrows, chn. engr., bituminous macadam and concrete paving 0.56 mi. Project NRH 22-J, Caribou, to Jos. P. McCabe, Inc., 509 East 1st St., South Boston, Mass., $47,622. Bids Oct. 3, awarded Oct. 8. Rejected bids Oct. 3, gravel surfacing 0.25 mi. Project NRH 258-A, Grafton.

Maryland—State Roads Comn., Baltimore, gravel paving 2.63 mi. Contr. AA-172-1-79, Federal Aid Project NRS 339-A (1935) Anne Arundel Co., to C. J. Langenfelder & Sons, Rosedale, $40,188. **P.W.A.**

Mass., Amesbury—Town, A. E. Webster, chn. Bd. Selectmen, Town Hall, bituminous macadam surfacing 17,700 sq.yd. Main, Elm, Market and Friend Sts., to Jas. E. Watkins Co., Inc., Powow St., $16,555. Bids Oct. 1; 6 in. bituminous macadam surfacing 6,400 sq.yd. South Hampton Rd., Docket 5768, to R. G. Watkins & Co., 29 Powow St., $10,139. Bids Sept. 24; **P.W.A.** Noted Sept. 27 and Sept. 20.

Mass., Boston—City, Dpt. P. Wks., C. J. Carven, comr., City Hall Annex, sheet asphalt paving Woodrow Ave. from Blue Hill Ave. to Norfolk St., to A. R. Doyle, Inc., 44 Perkins St., Jamaica Plain, $36,611. **P.W.A.** Bids Sept. 24, awarded Oct. 9. Noted Sept. 13.

Mass., Brookline—Commonwealth of Massachusetts, Dpt. P. Wks., F. E. Lyman, comr., type "D" bituminous concrete surfacing 11,400 sq.yd. and type "C" bituminous concrete surfacing 15,260 sq.yd. hy., to Simpson Bros. Corp., 193 Hanover St., Boston, $24,134. Bids Oct. 2, awarded Oct. 4.

Michigan—State Hy. Comn., Lansing, grading, shaping, drainage, capping existing 20 ft. concrete pavement with vitr. brick surfacing and widening 2.69 mi. NRH 41-42C-3, and NRM 41-42C-4, Kent Co., to State Road Builders Inc., Grand Rapids, $165,461***grading, shaping, drainage, concrete paving 2.611 mi. NRH 32-39C-1, Huron Co., to C. A. Handeyside Constr. Co., 11-169 General Motors Bldg., Detroit, $64,484***shaping, concrete paving 3.649 mi. NRH 13-27C-2, Calhoun Co., to Loselle Constr. Co., Wyandotte, $96,012. Grand total $325,957. **P.W.A.** Bids Sept. 28.

Minnesota—State Hy. Dpt., St. Paul, concrete paving 13,900 sq.yd. State Project 2-203-12 NRH 491-A and S.P. 2-203-22 NRM 491-B, in Duluth to C. F. Scully Equipment Co., 510 Guardian Bldg., St. Paul, $21,088 and $10,258 respectively. **P.W.A.** Bids Sept. 21. Noted Sept. 13.

Missouri—State Hy. Dpt., Jefferson City, to L. L. Sharp, Springfield, grading 2.665 mi. Christian Co. $7,190***to Snyder-Johnson, Inc., Humboldt, Ia., 0.141 mi. Clinton Co. $10,237 ***to O. H. Schmidt, Inc., St. Joseph, [illegible] mi. Nodaway Co., $10,084***to Lay Constr. Co., North Kansas City, 0.208 mi. Wash. Co. $38,613***to Hoover Bros. Constr. Co., Kansas City, 2.159 mi. Caldwell Co., $[illegible] 4.135 mi. Missouri City Rd. East, $8,290***to [illegible] mi. Barry-Gashland Rd., $6,143, both Clay Co. ***to Kiefner & Guile Constr. Co., Perry, [illegible] 4.977 mi. Sect. 506A, Route 51, Menfro, $11,306; 4.941 mi. same road Sect. 506B, $8,411, both Perry Co.***to Carte Harris Constr. Co., West Plains, 0.351 mi. Texas Co., $36,619; 2.083 mi. Howell Co, $11,790; 2.3[illegible] Sect. 4, Farmington Rd. N., $2,983; 3.06[illegible] Sect. 5 same road, $4,287, both St. Francois Co.***to M. Wunderlich, Jefferson City, [illegible] mi. in Plato, $2,390; 1.319 mi. Plato-Licking Rd., Sect. 3A, $11,606, both Texas Co.***to Samples & Elsea, Kirksville, 3.579 mi. Clinton Co. $8,539; 3.699 mi. Kirksville Northeast Rd., Sect. 382A1, $6,941; 3.555 mi. Sect. 382B1, same road, $6,697; 3.159 mi. same road $5,962, all foregoing Adair Co.***to Condon, Cunningham, & Lemmon, Kirkwood, 0.1 mi. Buchanan Co. $10,177; 0.063 mi. Ozark Co. $14,298***to Chaney, Amyx, Springfield, [illegible] eling 5 mi. Howell Co. $4,303***to Henry Constr. Co., Richmond, 3.855 mi. Caldwell Co. $5,480***to E. W. Jowett, Shelbina, 3.[illegible] Schuyler Co. $7,104***to Kelley & Underwood, Granby, 0.277 mi. Oregon Co. $41,558; 3.[illegible] mi. Jasper Co. $110,242***to Nevada Constr. Co., Nevada, 3.312 mi. Warsaw-Coal Rd., Sect. 438C1, $3,949; 2.883 mi. Sect. 438D1, same road, $3,444, both Henry Co.; 4.657 mi. Sect. 438A1, same road, $5,428; 4.507 mi. Sect. 438-B1, same road, $5,376, both Benton Co.; 2.419 mi. Aldrich-Walnut Rd., Sect. 399A1, $1,135; 3.485 mi. Sect. 399B1, same road, $1,304; 4.197 mi. Sect. 399C1, same road, $1,680, all foregoing Polk Co.***to J. A. Kerr, Ozark, 4.543 mi. Marshfield-High Prairie Rd., Sect. 462A, $2,389; 4.891 mi. Sect. 462B, same road, $2,278***to F. T. O'Dell Co., Hannibal, 2.81 mi. Forristell-Coppeln Rd., Sect. 461A, $11,428; 2.887 mi. Sect. 461B, same road, $14,143*** to J. L. Pohl, Nevada, 3.642 mi. Dompier-Oxly Rd., Sect. 400A1, Ripley Co., $3,491; 4.357 mi. Route 15- Thompson Rd., Sect. 434-B1, $5,514; 4.357 mi. Sect. 434A1, same road, $5,318, both Audrain Co.***to C. H. Atkinson Paving Co., Chillicothe, crushed stone or gravel [illegible] 0.284 mi. Route 169-Alanthus Grove Rd., Sect. 416B1, $630; 4.942 mi. same road, Sect. 416A1, $10,187, both Gentry Co.; 0.075 mi. Livingson Co., $26,941***to Deitz Hill Develop. Co., Kansas City, 3.087 mi, Concordia Rd., Sect. 446A1, Lafayette Co., $4,799; 0.363 mi. Clay Co., $722; 3.788 mi. Latham-Holt Rd., Sect. 388C1, $5,292; 3.545 mi. Sect. 388D1, same road, $6,492, both Clinton Co.***to R. Zink, Appleton City, 2.361 mi. Route-6 North, Sect. 417B, $4,569; 4.464 mi. Sect. 417A1, same road, $8,714, both Daviess Co.; 3.069 mi. Sheldon Rd., Sect. 404B1, $3,243; 3.378 mi. Sect. 404A1, same road, $4,000, both Vernon Co.***to Kuhn & Pyle, Pattonsburg, 4.014 mi. Kearney-Route 69 Rd., Sect. 387A1, $6,882; 3.161 mi. Sect. 387B1, same road, $5,528, both Clay Co.; 3.251 mi. Beverly-Farley Rd., Sect. 413A1, $9,370; 3.246 mi. Sect. 413B1, same road, $9,345, both Platte Co.***to A. L. Cook, Ottawa, Kan., chats or crushed stone surfacing 3.977 mi. Deerfield-Richards Rd., Sect. 405A1, $4,753; 3.816 mi. Sect. 405B1, same road, $4,585; 4.545 mi. Route 52-Amsterdam Rd., Sect. 383A1, $6,511; 4.117 mi. Sect. 383B1, same road, $5,468, both Bates Co.; 3.066 mi. Shelbyville-Philadelphia Rd., Sect. 5, $3,198; 3.529 mi. Sect. 4, same road, $3,628, both Marion Co.***to Service Constr. Co., Poplar Bluffs, concrete paving 1.02 mi. Poplar Bluff-Route 22 Rd., $95,006; 4.228 mi. Sect. 58A2, same road, $139,589; 2.711 mi. Sect. 58B1, same road, $98,078, all foregoing Butler Co. ***to Lay Constr. Co. and Powers Thompson Co., North Kansas City, 3.699 mi. Marion Co., $134,116***to Imperial Constr. Co., Leavenworth, Kan., 4.079 mi. Clay Co., $162,325. Grand total $1,229,270. **P.W.A.** Rejected bids Sept. 28 roads in Shelby and Lincoln Counties. Bids Sept. 28. Noted Sept. 20.

Mo., St. Louis—Bd. P. Service, City Hall, concrete paving 4.875 sq.yd. Wellington Ave. to Eyermann Contg. Co., 1210 South Grand Blvd., $15,115 est. $24,000; rein.-con. paving 3,270 sq.yd. Leamington Ave., to Webb-Boone Paving Co., 5103 Fyler Ave., $13,142 est. $20,800. Bids Oct. 2. Noted Sept. 13.

Nevada—State Hy. Comn., Carson City, oil processing 49.78 mi. roads in Clark and Lincoln Counties, to J. C. Compton, McMinnville, Ore., $81,339 est. $111,090***2.71 mi. Clark Co. to Union Paving Co., Call Bldg., San Francisco, Calif., $45,412 est. $50,455***grading, draining, graveling 7.35 mi. White Pine Co., to Isbell Constr. Co., Carson City, $39,839 est. $41,494. Grand total $166,590. Bids Oct. 10.

†**N. J., Fort Monmouth**—Con. Q.M., roads, fill, excavation, etc., to C. J. Hesse, Belford, N. J., $3,924. Bids Sept. 26.

New Mexico—State Hy. Comn., Sante Fe, improving roads in Gallup Co., to Kirchhof-Hanes, Inc., Albuquerque, $56,547 est. $56,544*** Guadalupe Co., to Cook & Ransom, Ottawa, Kan., $97,279 est. $90,609***Valencia Co., to H. Thygesen, Albuquerque, $9,224 est. $10,122 ***Sierra Co., to A. O. Peabody, Las Cruces, $79,534 est. $118,217***Valencia Co., to L. R. Allison, Albuquerque, $126,203 est. $165,252. Grand total $368,787. **P.W.A.** Bids Oct. 11. Noted Oct. 4.

New York—A. W. Brandt, comr. Hys., Albany, concrete paving 1.6 mi. IP 34-7 and [illegible]

†*Federal Government.*

Streets and Roads (Continued)

concrete paving, water supply, miscellaneous work 1.34 mi. IP 34-6, in Queens Co., to Garofano Constr. Co., Mount Vernon, $204,175 and $137,092 respectively est. $225,129 and $153,568 respectively***4.66 mi. Madison Co., to Dale Eng. Co., Utica, $161,263 est. $196,198 ***concrete paving 2 mi. Cortland Co. and graveling 5.54 mi. Onondaga Co., to C. D. Murray Co., Inc., Syracuse, $94,723 and $19,629 respectively est. $105,389 and $26,792 respectively***mix method surfacing 0.27 mi. Chenango Co., to J. F. Paddelford, Sherbourne, $27,969 est. $31,708***graveling 6.37 mi. Steuben Co., to A. L. Blades, Hornell, $33,816 est. $47,935***4.42 mi. road in Ontario Co., to M. E. Colle, Inc., Le Roy, $23,821 est. $34,191*** 4.19 mi. Broome Co., to Binghamton Constr. Co., Inc., Binghamton, $24,922 est. $30,561***3.97 mi. Lewis Co., to M. K. Eng. Co., Inc., Plaza St., Albany, $22,454 est. $26,414***concrete paving 7.64 mi. Herkimer Co., to Madison County Constr. Co., Inc., Solsville, $252,710 est. $308,991***5.27 mi. in Ontario Co., to J. Bellardino, Seneca Falls, $164,225 est. $215,985*** 8.08 mi. Dutchess Co., to T. A. Brogan, Yonkers, $351,363 est. $462,084***2.99 mi. Wayne Co., to Manitou Constr. Co., 183 East Main St., Rochester, $168,699 est. $200,879***paving 3.5 mi. Warren Co., to D'Onfro Bros., Inc., Gloversville, $151,631 est. $175,599***3.89 mi. Chemung Co., to Warren Roads Co., Cambridge, Mass., $241,384 est. $289,235***3.79 mi. Herkimer Co., to Utica Constr. Co., Utica, $77,355 est. $104,213***1.29 mi. Schuyler Co., to Bolton, Suits, Bolton & Gibbs, Watkins Glen, $10,725 est. $12,395. Grand total $2,167,955. **P.W.A.** Bids Sept. 11 and 25, Oct. 2, and 9. Noted Aug. 30, Sept. 13 and 27.

N. Y., Niagara Falls—City, W. F. Robbins, mgr., reconditioning streets in various parts of city by day labor. TERA project. $180,000.

N. Y., Riverhead—Suffolk Co., improving 2 mi. 7th St., to Immick Co., Meridian, Conn., $94,800. Bids Sept. 25.

North Carolina—State Hy. & P. Wks., Raleigh, concrete or bituminous concrete paving 0.74 mi. Project 1823, Pitt Co., to J. P. McGuire, Durham, $24,365. Bids Sept. 26.

North Carolina—State Hy. & P. Wks., Raleigh, bituminous surface treating 5.78 mi. Project 4096, Durham Co., to Gregory-Chandler Co., Inc., Virgilina, Va., $20,802***cement bound macadam paving 1.24 mi. Project 446, Rowan Co., to Brown Paving Co., Lexington, $21,419*** concrete paving 0.18 mi. Project 7222, Caldwell Co., to Ames & Webb, Inc., P. O. Box 1239, Raleigh, $10,257. Grand total $52,478. Bids Sept. 26.

Oregon—State Hy. Comn., Portland, grading 3.8 mi. road in Tillamook Co., to Jacobsen Jensen Co., Portland, $94,725. Bids Oct. 1. Noted Sept. 27.

Oregon—State Hy. Comn., Portland, grading culverts Baker Co., to J. A. Terteling, Boise, Idaho, $46,473***3.43 mi. Harney Co., to Morrison-Knudson, Boise, Idaho, $147,800***1.89 mi. Jefferson Co., to Colonial Constr. Co., 326 1st St., Spokane, Wash., $94,363***Lynn Co., to G. L. Stebbins Constr. Co., Klamath Falls, $44,445***grading, paving 1.42 mi. Swift Secondary Rd., to Parker Schram Co., Couch Bldg., Portland, $49,897***surfacing 14 mi. Wheeler Co., to Joslin & McAllister, East 3038 Trent St., Spokane, Wash., $19,620. Grand total $402,598. Rejected bids Oct. 11 road in Malheur Co. Noted Sept. 27.

Pennsylvania—At office S. S. Lewis, secy. Dpt. Hys., Harrisburg, rein.-con. paving 1.34 mi. Route 200, Sect. 2, Spring Creek Twp., Warren Co., to J. C. Devine Constr. Co., Meadville, $48,570***native or modified broken stone base with bit. penetration surfacing 2.25 mi. Route 33033 and Route 650 Spur, Winslow Twp., Jefferson Co., to Minns Bros., 117 East DuBois Ave., DuBois, $54,645***rein.-con. paving 1.84 mi. Route 35009, Sect. 3, Brook and Roaring Brook Twps., Route 35009 Sect. 3, and 1.89 mi. same road, Sect. 4, Roaring Brook Twp., Lackawanna Co., to S. J. Groves & Sons Co., Ridgefield, N. J., $94,706 and $98,943 respectively. Grand total $296,864. **P.W.A.** Bids Sept. 28. Noted Sept. 20.

Pennsylvania—See "Sewerage and Waste Disposal."

Pennsylvania—At office S. S. Lewis, secy. Hys., Harrisburg, bituminous penetration on native stone or modified stone base paving 1.12 mi. Route 349, Milford Twp., Juniata Co., to Donaghmore Coal & Stone Co., 1218 Chestnut St., Lebanon, $22,312 2 rein.-con. paving 2.06 mi. Route 101, Sect. 1-B, Liberty Twp., McKean Co., to Tri-State Eng. Co., Waynesburg, $75,009. **P.W.A.** Bids Sept. 28. Noted Sept. 20.

Pennsylvania—At office S. S. Lewis, secy. Hys., Harrisburg, rein.-con. paving 1.15 mi. hy. and constructing 1 rein.-con structure, on Route 43043, County Aid Appl. 9477, Mercer Co., to Koski Constr. Co., 4624 State Ave., Ashtabula, O., $41,613, bids Sept. 14: rein.-con. paving 1.03 mi. hy. and constructing 1 rein.-con. arch and 2 plate girder underpasses, Route 35009, Sect. 2, Scranton, Lackawanna Co., to Sweeney Bros., 207 North Washington Ave., Scranton, $208,035. **P.W.A.** Bids Sept. 21.

Pennsylvania—At office S. S. Lewis, secy. Hys., Harrisburg, rein.-con. paving 0.19 mi. Route 55, Sect. R-7, Tyrone Boro, Blair Co., to I. B. and J. B. Fogle, Hollidaysburg, $14,693***1.16 mi. Route 113, Sect. 13-A, North Bethlehem Twp., Washington Co., to J. I. Dick, Scottdale, $65,500***dual type paving 2.09 mi. Route 126, Sect. 1, Jackson and Manchester Twps., York Co., to H. J. Williams Co., Inc., Summer St. and W.M.R.R., York, $103,928***dual type paving 2.08 mi. Route 34, Sect. 1-B, Camp Hill Boro and Hampden Twp., Cumberland Co., to Hempt Bros., Camp Hill., $99,060***rein.-con. bridge and rein.-con. paving 0.02 mi. Route 109, Bridge 7, Washington Twp., Greene Co., to C. B. Palumbo, 837 Estella Ave., Pittsburgh, $12,646. Grand total $295,827. **P.W.A.** Bids Sept. 28. Noted Sept. 20.

†Pa., Middletown—Con. Q.M., Air Depot, constructing roads and sidewalks, to Union Paving Co., 1227 North Broad St., Phila., $33,833. Bids Sept. 12.

South Dakota—State Hy. Comn., Pierre, to Jarvis, Wright & Howell, Sioux Falls, grading 18.012 mi. Codington Co., $72,211***to C. W. McNamara, Sioux Falls, 12.144 mi. Lake Co., $38,375***to D. Gustafson, Sioux Falls, 5.797 mi. Yankton Co., $33,740***to H. J. Hawley, Aberdeen, 12.343 mi. Edmunds Co., $28,774; 8.336 mi. Campbell Co., $20,243***to E. L. Marss & C. R. Clinkerbeard, Valentine, Neb., 4.404 mi. Gregory Co., $10,837***to Gross & Stevens, Scotts Bluff, Neb., 4.007 mi. Jones Co., $15,690***to Philip Constr. Co., Philip, 4.546 mi. Charles Mix Co., $6,677***to J. L. Healy Constr. Co., Manchester, 8.912 mi. Aurora Co., $7,402; 8.03 mi. Aurora Co., $5,859***to Lindekugel & Kolberg, Spencer, 6.998 mi. Hanson Co., $4,645; 6.011 mi. Davison Co., $3,014; 6.953 mi. Davison Co., $5,313***to F. Schuknecht, Parker, 4.102 mi. Turner Co., $2,664; 4.991 mi. Turner Co., $4,370***to R. Backhaus, Madison, 5.493 mi. McCook Co., $4,043***to W. E. Bartholow & Son Constr. Co., Huron, 3.956 mi. Miner Co., $1,990***to C. A. Wagner Constr. Co., Sioux Falls, 4.444 mi. Lincoln Co., $8,269; 8.872 mi. Lincoln Co., $7,052***to Inland Constr. Co., 3867 Leavenworth St., Omaha, Neb., 15.335 mi. Pennington Co., $9,464***to Central Constr. Co., Sioux Falls, 15.803 mi. Stanley Co., $17,584. Grand total $309,216. Bids Oct. 10. Noted Oct. 4.

Utah—State Rd. Comn., Salt Lake City, concrete paving roadway shoulders 3.319 mi. road in Davis Co., to Ryberg Bros., Interurban Depot Bldg., Salt Lake City, $122,376 est. $110,096. **P.W.A.** Bids Oct. 5.

Vermont—State Hy. Dpt., H. E. Sargent, ch. engr., Montpelier, grading, base and drainage 1.8 mi. Project NRH 81-G, Walden Co., to B. A. Gardetto, Inc., 58 West Central St., Natick, Mass., $23,968. **P.W.A.** Bids Sept. 28, awarded Oct. 8.

†Va., Fort Monroe—Con. Q.M., paving Langley Field, to Trunstall Johnson Co., Norfolk, $5,850.

†Washington—Pub. Rds., Post Office Bldg., Portland, Ore., reconstructing and subgrade reinforcement on 6 mi. Wind River National Forest Hy., Skamania Co., 20 ft., to Hazard & Wachter, Sherman, $20,952.

Wash., Seattle—Bd. P. Wks., City Hall, widening, paving West 65th St. between 3rd and 32nd Aves. N.W., to Fiorito Bros., 110 Leary Ave., Seattle, $34,268.

Wash., Yakima—Yakima Co., paving 0.75 mi. Summitview Ave., to Mid State Contg. Co., Yakima, $41,958. Bids Oct. 4.

Ontario—Dpt. Hys., Parliament Bldgs., Toronto, grading, culverts 6 mi. Kaladar Rd. S. Contr. 34-77, to Campbell Constr. Co. Ltd., 67 Yonge St., Toronto***concrete paving 8 mi. Waverly Rd. S., Contr. 34-78, to Sterling Constr. Co. Ltd., 50 Sandwich St., East Windsor*** 3rd bridge south of Tralee, Contr. 34-80, to W. G. Campbell Constr. Co., 142 Geoffrey St., Toronto***Schamking Bridge, Contr. 34-81, to General Contractors Ltd., 332 Warren Rd., Toronto***Otter Creek Bridge, south of Tillsonburg, Contr. 34-82, to R. A. Blyth, 164 Indian Rd. Cres., Toronto***Allenburg Bridge, Contr. 34-83, to Cameron & Phin, Welland***1st bridge south of Tralee, Contr. 34-79, to J. Gaffney, West Monkton***additional 10 ft. of concrete paving on 8 mi. road from Clinton North to Contr. 34-11, to McArthur Eng. & Constr. Co., 15 Dundas St., Guelph***on 15 mi. road from Dundalk to Merkdale Contr. 34-12, to King Paving Co. Ltd., Box 619, Oakville***7.3 mi. Midhurst N., Contr. 34-14, to Curran & Briggs, 203 Manning Chambers, Toronto. Est. $600,000.

EARTHWORK, IRRIGATION DRAINAGE AND WATERWAYS

PROPOSED WORK

Tenn., Chattanooga—City, Com. Z. H. Taylor, appointed 4 engineers to make survey of Chattanooga Creek for distance of 3 mi. (from Georgia State line) to determine work necessary to make it sanitary. City will then seek P.W.A. aid in dredging, erecting pumping stations, etc. Unofficial survey several months ago estimated the work at about $1,000,000. W. H. Wilson, Municipal Bldg., engr.

Tex., Raymondville—Willacy Co. Water Control & Impvt. Dist. 1, c/o O. K. Dickinson, pres., revised plans approved by P.W.A. and bonds approved by Attorney General for construction irrigation system, pressure system to serve 74,720 acre tract. Bids soon. $4,853,000. P.W.A. project. P. A. Welty, 1111 Fair Bldg., Fort Worth, consult. engr. Noted Mar. 8.

BIDS ASKED

†Florida—Oct. 26 (extended date), by U. S. Eng., Jacksonville, constructing Div. 9 Lake Okeechobee, Florida Project.

Tex., Orange—Oct. 29, by Orange Co. Water Co., Inc., c/o C. C. Leddy, agt., irrigation and water system, incl. pumping plant and system to water 40,000 acres, involving 235,000 cu.yd. dry earth excav., 2,000 ft. existing canal, 62.5 acres clearing and grubbing for 150 ft. intake canal. Est. $489,000. W. B. Gregory, Tulane Campus, New Orleans, La., engr. Noted July 26.

Tex., Orange—Oct. 29, by Orange Co. Conservation & Reclamation Dist., c/o C. C. Leddy, chn., Orange, drainage work, dredging bayous and creeks, incl. 759,446 yd. excav. for relief ditch and water lateral Little Cypress Bayou; 728,081 yd. excavation for Upper Adams Bayou; 120,000 yd. excav. for lower Adams Bayou; 1,634,976 yd. excav. for Upper Cow Bayou, 250,000 yd. excav. for Lower Cow Bayou; 185,912 yd. excav. for Gum Slough. $378,000. P.W.A. project. F. Schutts & Sons, Orange, engr. Noted July 26.

†W. Va., Grafton—Oct. 23 (extended date), by U. S. Eng., Pittsburgh, Pa., constructing Tygarts Valley River Dam. Noted Sept. 20.

CONTRACTS AWARDED

Calif., Los Angeles—Flood Control Dist., 205 South Bway., S. M. Fisher, engr., constructing timber facing for San Gabriel Dam 2, involving 3,500 cu.yd. excav., 5,000 cu.yd. fill, pumping 1,500,000 gal. water, remove 285,000 sq.ft. concrete slab, placing 775 MBM lumber, placing 1,100 cu.yd. gunite, placing 375 cu.yd. concrete, to Case Constr. Co., 905 Westminster St., Alhambra. $169,627. Bids Oct. 1, awarded Oct. 2.

†Illinois—U. S. Eng., 932 Post Office Bldg., Chicago, dredging 790,200 cu.yd. from lower Illinois River, to American Aggregates Corp., Greenville, O., $134,334. Bids Sept. 27. Noted Sept. 13.

†New York and New Jersey—U. S. Eng., 39 Whitehall St., New York, dredging 18,100 cu. yd. rock and 76,100 cu.yd. other material from Hudson River Channel, New York and New Jersey, to M. A. Breymann, 18 Battery Pl., New York. $128,207. Bids Sept. 21. Noted Sept. 13.

†Pa., Pittsburgh—U. S. Eng., Keenan Bldg., excavating navigation channel at Corley's Island Pool 6, Allegheny River, to Monongahela & Ohio Dredging Co., Oliver Bldg., $58,549. Bids Sept. 21.

Rhode Island — State Emergency P. Wks. Comn., State House, Providence, awarded contract for improvements at Point Judith, to Merritt,Chapman & Scott Corp., 292 Pequot Ave., New London, Conn., and 17 Battery Pl., New York. $220,250. This contract tentatively awarded 3 weeks ago to Tucker Constr. Co., 348 Washington St., Providence, but Federal Government ruled against that award on ground that completion could not be affected by Dec. 31, also that bid was not in effect the lowest. Noted Sept. 20, under "Contracts Awarded."

†Washington—Mason-Walsh-Atkinson-Kier Co., general contractors, Peyton Bldg., Spokane, 31 mi. power line from Coulee to Coulee Dam site with 2 poles and crossmember, insulators hanging, single transmission line of 3-phase type, to H. H. Walker, Inc., and F. Ziebarth, 1323 Vence Blvd., Los Angeles, Calif., $80,000; furnishing 3,000,000 ft. lumber in ready-to-erect shapes and cuts for Mason City dwellings at Coulee Dam site, to White Pine Sash Co., East 4005 Bway., Spokane, approximately $200,000, for Bureau of Reclamation, Denver, Colo. Noted July 19, under "Contracts Awarded."

†Wisconsin and Minnesota—U. S. Eng., 615 Commerce Bldg., St. Paul, Minn., constructing 13 channel markers in Pool 5, Mississippi River between Alma, Wis., and Minneiska, Minn., to A. Beckman & Graus, Lake City and Hastings, Minn., $18,825. Bids Sept. 27.

Wis., Racine—See "Sewerage and Water Disposal."

†Wis., Trempealeau—U. S. Eng., St. Paul, Minn., constructing Dam 6, on Mississippi River, to Spencer, White & Prentis, 10 East 40th St., New York. $1,668,442. Bids Oct. 2. Noted Sept. 13.

Man., St. Andrews Lock—Secretary Dpt. P. Wks., Ottawa, Ont., constructing lock gates, to Carter-Halls-Aldinger Co. Ltd., Winnipeg, $24,124. Est. $18,200.

N. B., St. George—Dpt. P. Wks., Ottawa, Ont., extending wharf, to B. H. Williamson, St. George, $12,302.

Ont., Port Stanley—Secretary Dpt. P. Wks., Ottawa, dredging in harbor, to Canada Dredging Co. Ltd., Ottawa. $28,000. Est. $30,000.

Que., Pointe du Lac—Dpt. Marine, Ottawa, Ont., rein.-con. superstructure cribwork pier, (Lake St. Peter), to Laval Constr. Co. Ltd., Montreal, $12,800.

Que., St. Lambert—Dpt. P. Wks., Ottawa, Ont., constructing concrete protection wall, to P. Baillargeant & C. Poiriert, St. Lambert, $25,781. Est. $30,000. K. M. Cameron, c/o owner, engr.

Que., Sorel—Secretary Dpt. P. Wks., Ottawa, Ont., refacing stone Dam 2 on St. Lawrence River, near here, to Dufresne Constr. Co. Ltd., Montreal, $45,000. Noted Sept. 27.

(Constr. News page 151)

†*Federal Government.*

UNCLASSIFIED

PROPOSED WORK

Colo., Leadville—TUNNEL—Twin Lakes Land & Water Co., Ordway, petitioning R.F.C. for funds to bore small tunnel to tap Roaring Fork and Lost Man Creeks, north of Lincoln Gulch to connect with $1,250,000 tunnel now under construction.

N. Y., New York—PIER—Dpt. Docks, Pier A, North River, soon takes bids constructing Pier 25, 125x992 ft., steel, concrete, North River, Franklin and North Moore Sts. $774,000. P.W.A. loan granted. F. T. O'Keefe, c/o owner, engr. Eastern Steamship Lines, Pier 25, lessee. Noted May 3.

N. Y., New York—PIER—Dpt. Docks, Pier A, North River, soon takes bids completing Pier 45, 100x866 ft., steel, concrete, incl. elevators, conveying equipment and heating, West 10th St. and Hudson River. $1,282,000 allotted by P.W.A. F. T. O'Keefe, Pier A, North River, engr. Italian Terminal Service, c/o Italian Lines, 1 State St., New York, lessee. Noted May 3.

N. Y., New York—STEEL SHED, etc —Dpt. Docks, Pier A, North River, soon lets contract steel shed and fireproof dumping platform, East 107th St. and Harlem River. To exceed $100,000. P.W.A. funds allotted. F. T. O'Keefe, c/o owner, engr.

Okla., Woodward — PARKS — See "Waterworks."

Wyoming—STEEL PIPE LINE—Corporation, c/o H. P. Rothwell, Gillette, plans 25 mi. steel pipe line from producing fields to Gillette.

BIDS ASKED

Conn., Gaylordsville—TRACT DEVELOPMENT —See "Contracts Awarded."

La., New Orleans—FERRY LANDING APPROACHES—See "Contracts Awarded."

New York—TRACKS and CONTACT RAIL—Oct. 30, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, installing tracks and contact rail for Route 103, Sect. 4, and Route 109, Part of Sect. 1, for Rapid Transit Railway, in vicinity of Madison and Rutgers Sts., Manhattan Boro, under Rutgers St. and intersecting streets to East River, thence under East River to Jay St., Brooklyn Boro, connecting with other railroad at Chapel St. P.W.A. project.

N. Y., Brooklyn—SWIMMING POOL—See "Contracts Awarded."

North Carolina—CORE DRILLING at MINE—Oct. 24, by W. L. Craven, bridge engr., State Hy. and P. Wks., Raleigh, core drilling on Carbonton Mine property, northeastern part of Moore Co. To exceed $3,000.

B. C., Duncan—HIGH TENSION LINE—See "Contracts Awarded."

CONTRACTS AWARDED

California — STEEL TANKS, etc. — Standard Oil Co. of California, 225 Bush St., San Francisco, five 138,000 bbl. steel tanks for oil storage at Eastern Terminal of Rio Bravo-Estero pipe line, at Bakersfield or Rio Bravo, to Western Pipe & Steel Co., 444 Market St., San Francisco***grading and concrete founds., to Owl Truck & Materials Co., 420 South Alameda St., Compton***constructing six 138,000 bbl. steel tanks for oil storage at western terminal of Rio Bravo-Estero Bay pipe line, at Estero Bay, San Luis Obispo Co., to Consolidated Steel Corp., Slauson and Eastern Aves., Los Angeles***grading and concrete found., to Lang Transportation Corp., 5501 Santa Fe Ave., Los Angeles. Awarded Oct. 1. Noted Aug. 30.

Calif., Richmond—WHARF—Standard Oil Co. of California, 225 Bush St., San Francisco, redecking and new piling wharf on Outer Harbor, to Healy-Tibbitts Constr. Co., 64 Pine St., San Francisco. $30,000. Awarded Oct. 3.

Conn., Gaylordsville—TRACT DEVELOPMENT —H. Seiffert, c/o J. E. Roth, Gaylordsville, tract development and 1 and 2 story, brick, frame dwellings, Sherman-Gaylordsville Hy separate contracts. To exceed $100,000. Noted Sept. 27.

Mass., Springfield—COAL STORAGE PLANT —Household Fuel Corp., W. H. Bliss, mgr., 176 Armory St., coal storage plant, incl. elevating and conveying machinery, to Nicholson Co., Chrysler Bldg., New York, approximately $30,000.

La., New Orleans—FERRY LANDING APPROACHES—Bisso Ferry Co., constructing approaches to ferry landings at New Orleans and Gretna, steel approaches on creosoted pile founds. and two 1 story, stucco frame waiting rooms, own forces. T. O. Hotard, Algiers, engr.

N. Y., Brooklyn—SWIMMING POOL—Dpt. Parks, Arsenal Bldg., Central Park, New York, swimming pool, Sunset Park, day labor. $40,000. A. Embury, c/o owner, archt.

N. Y., New York—COAL POCKETS—Public Fuel Service, Inc., 3-5 West 144th St., 2 story coal pockets, 5 West 144th St. to Barney Ahlers, 110 West 40th St., New York. Est. $28,000. **Maturity later.** Awaiting building permit. Noted Oct. 8.

N. Y., Syracuse—STORAGE TANK FOUNDATIONS, etc.—Tidewater Oil Co., 17 Battery Pa., New York, steel storage tank foundations, incl. wood piling, to Provo Bros., Hiawatha Blvd., $100,000. Awarded Oct. 7.

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N. Y., West New Brighton — SWIMMING POOL—Dpt. Parks, Arsenal Bldg., Central Park, New York, swimming pool, day labor. To exceed $30,000. **Maturity about Nov. 1.** A. Embury, c/o owner, engr. Noted Aug. 2.

R. I., Warwick—RUNWAYS—State Aviation Comn., P. W. Hathaway, chn., State House, Providence, concrete runways and drainage system at Rhode Island State Airport, to Lane Constr. Co., 37 Colony St., Meriden, Conn., Scheme "B" $343,390.

Texas—GAS PIPE LINE—Lone Star Gas Co., J. L. Foster, ch. engr., 1915 Wood St., Dallas, laying 70 mi. 12 in. gas line welded steel pipe, pipe to be taken up and replaced, coated with Johns-Manville wrapper, from Riesel to Long Lake Gas Field, Anderson Co., to A. F. Day Constr. Co., 132 North Lancaster St., Dallas. Total est. $2,000,000.

Texas—GAS LINE—Texas Gas Utilities Co., c/o H. L. Mann (receiver), Dal Rio, H. C. Wallace, ch. engr., constructing 12 mi. 4 in. steel welded joint gas pipe line from Zavalla Co. gas fields to Del Rio, to N. A. Saigh Co., c/o Builders Exch. Bldg., San Antonio, $45,000. Awarded Oct. 1.

†**Washington** — POWER LINE — See "Earthwork, Irrigation, Drainage, Waterways."

B. C., Duncan—HIGH TENSION LINE—British Columbia Electric Power Co., Ltd., 425 Carroll St., Vancouver, new high tension line from Bamberton to Duncan, also distribution lines by Duncan Utilities Co. Est. $100,000. Owner builds, by force account. J. Newell, c/o owner, engr.

MATERIALS AND EQUIPMENT

PROPOSED WORK

CEMENT—**Los Angeles, Calif.**—A. J. Holm, city purch. agt., City Hall, rejected bids furnishing 1,500 bbl. cement per month from Oct. 1, 1934, to Dec. 31, 1934, f.o.b. cars A. T. & S. F. Spur, McPherson St., per bbl. paper or cloth, or f.o.b. dealers plant, Spec. 3347. To exceed $2,000.

FIRE HOSE—**Pueblo, Colo.**—City Council, G. W. Clark, clk., plans purchasing 5,200 ft. fire hose after Jan. 1, 1935.

FIRE FIGHTING APPARATUS, etc.—**Hornell, N. Y.**—City, L. F. Wheatley, mayor, approved $12,000 bonds for purchasing fire fighting apparatus and equipment.

WELL DRILLING EQUIPMENT—**Syracuse, N. Y.**—T. and A. Boyce, 441 East General Parkway, soon takes bids complete deep well drilling equipment, $3,000 or more.

STEEL OIL TANK—**East Providence** (br. Providence), **R. I.**—Colonial Beacon Oil Co., 30 Beacham St., Everett, plans constructing 20,000 bbl. steel oil tank with concrete found., Dexter Rd. To exceed $17,750. Owner will award separate contracts. Private plans.

BIDS ASKED

DRILL STEEL—**Los Angeles, Calif.**—Oct. 30, by D. P. Nicklin, purch. agt. Dpt. Water & Power, 207 South Bway., furnishing, delivering 12 months from Nov. 1, 1934, drill steel, Spec. 1520 (1) in lots of 20 tons or more (2) in less than carload lots, per cwt. (a) f.o.b. bidders mill (b) f.o.b. dockside Los Angeles Harbor (c) f.o.b. cars Lone Pine (d) f.o.b. delivered to Dpt., camp sites, Mono Basin, estimated requirements 120,000 lbs., Spec. 1520. To exceed $2,000.

†FENCING, etc.—**San Rafael, Calif.**—Oct. 31, by Con. Q.M., Hamilton Field, constructing 732 lin. ft. fencing; two 20 ft., one 26 ft. four 10 ft. and two 13 ft. gateways.

†TRUCK—**Wash., D. C.**—Oct. 26, by Yards & Docks, Navy Dpt., Wash., D. C., truck, electric elevating platform, delivered to Puget Sound; steel, shapes, delivered to various east and west coast points.

PUMPS—**Greenwood, Miss.**—City Council taking bids two 10,000 and one 15,000 gal. minute vertical motor triplicate pumps to pump against head of 20 ft. with motor and starter. A. Bonner, city engr.

†SINGLE ROLLER CHOCKS—**Vicksburg, Miss.**—Oct. 24, by U. S. Eng., P. O. Box 667, 32 cast steel single roller chocks, complete with wheels.

STRUCTURAL STEEL—**New York, N. Y.**—Oct. 22, by R. Forbes, comr. Purchase, Municipal Bldg., structural steel to Dpt. Plant & Structures.

TRACTORS—**New York, N. Y.**—Oct. 25, by Dpt. Purchase, Municipal Bldg., crawler type tractors equipped with bulldozers to Dpt. Sanitation.

†CEMENT—**Huntington, W. Va.**—Oct. 23, by U. S. Eng., Huntington, 3,000 bbl. cement for U. S. Lock 14, Ohio River.

CONTRACTS AWARDED

GASIFYING PLANTS, etc. — **Los Angeles, Calif.**—D. P. Nicklin, purch. agt. Dpt. Water & Power, 207 South Bway., furnishing, delivering and installing 4 liquid petroleum gas fuel storage and gasifying plants at each of departments camps in Mono Camp, and furnishing, delivering, transfer to storage tanks at department's camp sites, in such quantities as may be required for 12 months, from date of contract, liquid petroleum, gas fuel f.o.b. bidders shipping point, or 4 camps, Mono Co., to Parkhill-Wade Co., 973 North Main St., $34,856. Bids Aug. 28, awarded Oct. 2.

HEATERS—**Los Angeles, Calif.**—D. P. Nicklin, purch. agt. Dpt. Water & Power, 207 South Bway., furnishing, delivering 32 heating and ventilating installations, incl. 420-16,000 BTU/hr. console type space heaters, fifteen 75 gal. 7 g.p.h. recovery, 49 auto storage water heaters twenty 15 gal. 20 g.p.h. recovery, three 20 gal. 20 g.p.h. recovery, five 27 gal. 20 g.p.h. recovery, fifteen 50 gal. 33 g.p.h. recovery, to Pacific Gas Radiator Co., 7615 Roseberry Ave., Huntington Park, $17,923; 257 console type space heaters, forty-three 16,000 BTU/hr. eighty-one 22,000 BTU/hr., one hundred and four 27,500 BTU/hr., twenty-nine 39,000 BTU/hr. capacity, to H. R. Bosford Co., 911 South Grand Ave., $7,555. Bids Aug. 27, awarded Oct. 2.

OIL CIRCUIT BREAKERS — **Los Angeles, Calif.**—D. P. Nicklin, purch. agt. Dpt. Water & Power, 207 South Bway., furnishing four 15,000 V. 3-pole single throw frame mounted outdoor type oil circuit breakers, Spec. 1475, to Westinghouse Electric & Mfg. Co., 420 South San Pedro St., $71,320. Bids Aug. 24, awarded Oct. 2.

CABLE—**Oakland, Calif.**—City Council, 5,620 ft. insulated cable, paper covered, to Electric Corp., 178 10th St., $1,433. Bids Sept. 20, awarded Oct. 3.

CAST IRON PIPE — **Oakland, Calif.** — City Port Comn., 1,500 ft. 8 in. and 800 ft. 6 in. c.i. pipe, elbows, fittings, etc., for water line in Dock Area, to U. S. Pipe & Fdry. Co., Monadnock Bldg., San Francisco, $2,431.

CAST IRON PIPE—**Santa Monica, Calif.**—Municipality, 150 tons 4 and 6 in. c.i. pipe, to American Cast Iron Pipe Co., 2930 North 16th St., Birmingham, Ala. Est. about $5,000.

WATERWORKS EQUIPMENT—**Goshen, Ind.**—City, equipment for waterworks, all valves, to Western Gas Constr. Co., Fort Wayne.

WATER SOFTENER—**Portland, Ind.**—City, C. V. Gott, mayor, new water softener for city light plant, to American Mfg. Co., Fort Wayne, $2,400.

CRACK FILLER, etc. — **Iowa** — State Hy. Comn., Ames, 650 tons asphalt crack filler, to Standard Oil Co., Equitable Bldg., Des Moines, $11,700***2,000 expansion joints, to Waterloo Constr. Co., Waterloo, $1,500***38 snow plows, to Royer Mfg. Co., Janesville, $5,936. Grand total $19,136. Bids Oct. 8.

CINDERS, etc.—**Boston, Mass.**—City, Supply Dpt., W. W. Loomis, supt., City Hall Annex, 10,000 cu.yds. cinders, to Jos. P. McCabe, Inc., 509 East 1st St., South Boston, $8,700*** 20,000 cu.yd. hard dry fill, to Cerulli Contg. Co., 174 Bayswater St., East Boston, $14,000, above material to be furnished to Park Dpt. at East Boston Airport. Bids Oct. 1, awarded Oct. 10.

PUMP—**Norwood, Mass.**—Town, W. C. Kendrick, genl. mgr., Town Hall, furnishing, installing electric driven centrifugal pump at Ellis Ave. Pumping Station, to F. A. Mazzur Co., 141 Milk St., Boston, Bids Oct. 1, awarded Oct. 8. Noted Aug. 29.

ASPHALTIC MATERIAL, etc. — **Stoneham, Mass.**—Town, Bd. Park Comrs., at office of Town Clerk, Town Hall, asphaltic material for construction of tennis courts, Pomeworth St. Playground, to T. A. Mulroney, 13 Avon St., $1,140; drilling and blasting ledge, to Wm. C. Doherty, Inc., 52 Summer St., $1,208. Rejected bids fencing and enclosing tennis courts.

†FEED PUMPS—**Montana**—U. S. Eng., Postal Telegraph Bldg., Kansas City, Mo., duplex boiler feed pumps for derrick boats at Fort Peck, to Union Steam Pump Co., Battle Creek, Mich., $720. Bids Oct. 3.

†HEATERS—**Montana**—U. S. Eng., 707 Postal Telegraph Bldg., Kansas City, Mo., feed water heaters for derrick boats at Fort Peck, to Black, Sivalls & Bryson. Bids Oct. 6.

†TESTING MACHINE—**Montana**—U. S. Eng., Kansas City, Mo., hydraulic universal testing machine, 200,000 lb. capacity, to Riehle Bros. Testing Machine Co., 1424 North 9th St., Phila., Pa., $5,562. Bids Oct. 5.

CEMENT, etc. — **Sutherland, Neb.** — Platte Valley Public Power & Irrigation Dist., G. Gentleman, secy., North Platte, 70,000 bbl. cement, to Ash Grove Lime & Portland Cement Co., 231 Sunderland Bldg., Omaha, and Nebraska Cement Co., 619 Farnam Bldg., Omaha, at $2.80 f.o.b. North Platte, and $2.72 f.o.b. Ogallala***6,000 bbl. special grade cement, to Monarch Cement Co., Humboldt, Kan., $3.01 f.o.b. Paxton, Neb***60 tons 1½ in. gage chicken wire, to Colorado Fuel & Iron Co., A. Roeder, trustee Continental Oil Bldg., Denver, Colo., $13,213. **P.W.A.**

†METAL SASH—**Boulder City, Nev.**—Bureau Reclamation, Dpt. Interior, Denver, Colo., metal sash windows, window operators, spandrils, panels, louvres, mullions, rolling doors, lanterns for Boulder Dam Power House, to Kawner Mfg. Co., 8th St. and Dwight Way, Berkeley, Calif., $107,023. Bids Aug. 27. Noted Aug. 16.

LIGNON BINDER—**Atlantic City, N. J.**—Atlantic Co., 136,000 gal. lignin binder for road work, to M. R. Young, 34 Fisher Pl., Trenton, $15,640.

†*Federal Government.*

Materials, etc. (Continued)

†**CULVERT PIPE—Milwaukee, Wis.**—U. S. Government, furnishing culvert pipe, to Union Iron Products Co., East Chicago, Ind., $2,780. Bids Oct. 1, awarded Oct. 8.

WATER STORAGE TANK—Osseo, Wis.—United Milk Products Co., 200 West 41st St., Cleveland, O., reinforced elevated water storage tank, to Tschopp-Durch-Comostral Co., 403 North High St., Chippewa Falls.

PUMP—Platteville, Wis.—City, booster pump, to Worthington Pump & Mchy. Corp., 400 West Madison St., Chicago, Ill., $2,470.

†**PIPE, etc.—Milwaukee, Wis.**—U. S. Forest Service, pipe and fittings, to March Auto Irrigation Co., Muskegon, Mich., $475***pipe, to Cordes Supply Co., 441 North 2nd St., Milwaukee, $112***culvert pipe, to H. V. Johnston Culvert Co., Minneapolis, Minn., $984***culvert pipe, to Wheeling Corrugated Co., 1729 Northeast Bway., Chicago, Ill., $1,760***culvert pipe, to Felker Bros. Mfg. Co., Marshfield, $1,257. Grand total $4,588. Bids Oct. 3.

TANKS—Port Stanley, Ont.—Thayers Ltd., London, constructing two 2 m.g. gasoline tanks and two 8 in. pipe lines from tanks to docks, to Horton Steel Co. Ltd., N. Ont. Bldg., Toronto, and Fort Erie, $50,000. Awarded Oct. 2.

FOREIGN

India, Simla—Director of Civial Aviation bids this year 140 ft. span hangars at Karachi, Allahabrad, Calcutta, Rangoon and Akyab, Rs 9,200,000, for aerodromes at Karachi, Delhi, Cawnpore, Calcutta, Akyab, Allahabad and Rangoon, Rs 11,51,000; for meteorological observatories Rs 581,000.

India, Simla — Chief Controller of Stores, Indian Stores Department, Engineering Division, wants prices on hand drawn copper wire, bare, for telegraph and telephones of 600 mi. at 200 lbs. per mile and 1,000 mi. at 300 lbs. per mi.; also 3 truck type switchgear units, each suitable for controlling 300 K.v.a. circuit on 11,000 volt 3 phase, 50 cycle system, 3 oil immersed self cooled indoor type transformers, with terminal boxes, 7 iron clad draw out pedestal type switchgears and pumping sets.

Mexico—Palmilla District Mines Corp., c/o L. B. Sawyer, 1st Natl. Bank Bldg., Cincinnati, O., mining development in various locations, by day labor. To exceed $40,000.

Union Socialist Soviet Republics — Commissariat of Heavy Industry, Moscow, or c/o Amtorg Trading Corp., 261 5th Ave., New York, electric locomotive plant, incl. construction of socialist city in Kashira (Moscow Region), by day labor. $140,000,000.

Union Socialist Soviet Republics—Commissariat of Heavy Industry, c/o Amtorg Trading Corp., 261 5th Ave., New York, constructing 25,000-100,000 tons electrolytic copper refinery at Pyshminsk, by day labor. To exceed $500,000.

Union Socialist Soviet Republics — Commissariat Communications, Moscow, or c/o Amtorg Trading Corp., 261 5th Ave., New York, 4,000 kilometer telephone and telegraph line connecting Moscow with Suerdlovsk, Novosbirsk and Staltinsk, by day labor. To exceed $1,000,000.

Union Socialist Soviet Republics—Commissarit of Heavy Industry, Moscow, or c/o Amtorg Trading Corp., 261 5th Ave., New York, preliminary plans steel and iron combine in East Silberian Region. To exceed $10,000,000. **Maturity later.**

Union Socialist Soviet Republics—Dpt. Musical Instruments, Commissariat of Light Industry, Moscow, or c/o Amtorg Trading Corp., 261 5th Ave., New York, piano factory, capacity 16,000 pianos, etc., at Leningrad, day labor. To exceed $500,000.

Union Socialist Soviet Republics—Soviet Government, Moscow, or c/o Amtorg Trading Corp., 261 5th Ave., New York, asphalt plant additions, at Batum, by day labor. To exceed $500,000.

DETAILS OF PWA NON-FEDERAL ALLOTMENTS

Loans and Grants Except as Noted. *Grant. †Loan.

KEY TO SYMBOLS

m-meters	**c**-canal
p-pump	**dm**-dam
t-tank or standpipe	**r**-reservoir
f-filtration	**tr**-treatment plant
d-distr. supt.	**b**-building
w-well	**i**-iron removal
s-supply	**pw**-power line
g-generator	**s**-softening
ch-chlorinators	**bl**-boilers

Water Works

Batesburg, S. Car. **r-s-f-d-**	$95,000
Fountain Green, Utah. **d**	40,000
Grove City, Ohio. **s-i**	12,000
Hagerman, N. Mex., **p-t-d**	49,000
Providence County, R. I. (Smithfield). **w-p-t-d**	187,000
Secretary, Md., **w-p-t-d**	21,000
*Wilmington, Del., **d**	11,000
Wingo, Ky., **w-p-t-ch-d**	36,000

Buildings

*Sykesville, Md. (alterations)	61,500

Schools

*Dickenson County, Va.	30,000
El Paso, Tex. (athletic field & stadium)	64,700
*Haymarket, Va. (Prince William County School Board)	14,000
New York, N. Y. (Jr. High School, Amsterdam Ave., 129th & 130th St.)	1,101,000
New York, N. Y. (H.S. Oakwood Heights, Staten Island)	1,110,800
*Osage City, Kans.	26,500
*Smithfield, Va.	10,000
Southwest Texas State Teachers Coll., School, San Marcos, Tex. (dormitory)	126,000
State Board of Education, Billings, Mont. (College buildings, E. Mont. Normal School)	250,000
University of Colo., Boulder, Colo. (Field House)	85,000

Miscellaneous

New York, N. Y. (Dock improvements, Sheepshead Bay St. to E. 27th Sts.)	428,000

PUBLIC BUILDINGS

PROPOSED WORK

Calif., Sacramento — Sacramento Dist. and County, election Nov. 6, $12,000,000 power plant and distribution system. Burns & McDonnell Eng. Co., 107 West Linwood Blvd., Kansas City, Mo., engrs. Noted Sept. 27.

Ill., Chicago—P.W.A. housing Division, 120 South LaSalle St., plans acquiring 160 acre site, wrecking present structures and constructing 2, 3 and 4 story homes and some row houses, recreation center, etc., on Racine, Ashland, Harrison and Roosevelt Rds. $8,000,000. Engineer and architect not appointed. Project approved by Secretary of Interior.

Minn., St. Cloud—City defeated amendment to city charter enabling city to issue revenue bonds to construct municipal electric power and distribution plant. $1,294,000. Burns & McDonnell, 107 West Linwood Blvd., Kansas City, Mo., engrs. Noted Sept. 20.

N. Y., Dongan Hills—Bd. Educ., 500 Park Ave., New York, soon takes bids Oakwood High School, brick, steel concrete, Oakwood Heights. $1,100,000. P.W.A. funds allotted. C. W. Martin, Flatbush Ave. extension and Concord St., Brooklyn, archt.

N. Y., New York—Bd. Educ., 500 Park Ave., New York, soon takes bids Junior High School, brick, steel, concrete, Amsterdam Ave. and 129th St. $1,100,000. P.W.A. funds allotted. W. C. Martin, Flatbush Ave. extension and Concord St., Brooklyn, archt.

BIDS ASKED

†**Calif., Long Beach** — Nov. 15 (extended date), by Treas. Dpt. at office Sup. Archt., Wash., D. C., furnishing interior of 4th to 7th floors (inclusive) U. S. Post Office, etc. Noted Sept. 13.

†**Calif., San Francisco**—Oct. 26 (extended date), by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing plague laboratory on U. S. M. H. Reservation. Noted Aug. 30.

†**D. C., Wash.**—Oct. 23, by Treas. Dpt. at office Sup. Archt., Wash., D. C., extending and remodeling U. S. Bond Vault 7

Ga., Reidsville—Nov. 20, by J. H. Johnston, state engr., 722 Citizens Southern Bank Bldg., Atlanta, prison, 4 story, basement, 50x100 ft. administration building, six 2 story, 50x250 ft. dormitories, structural steel, rein.-con. construction in addition to building, incl. steel bars and cells, waterworks system, sewage disposal plant and numerous other items and fencing entire reservation, for State, c/o Judge E. L. Rainey, chn. State Prison Comn., Atlanta, $1,300,000. Tucker & Howell, Rhodes-Haverty Bldg., Atlanta, archts. **P.W.A.** Noted Aug. 9.

†**Ky., Winchester**—Nov. 5, by Treas. Dpt. at office Sup. Archt., Wash., D. C., extending and remodeling U. S. Post Office.

†**Me., Bangor**—Oct. 22, by Treas. Dpt. at office Sup. Archt., Wash., D. C., elevator in U. S. Post Office.

Mass., Sterling—Oct. 22, by Town, Bd. Selectmen, Town Hall, for Junior-Senior High School, 2 story, basement, brick, steel, Princeton Rd. $125,000. Frost, Chamberlain & Edwards, 3900 Main St., Worcester, archts. Noted May 24.

Mass., Wellesley—Oct. 24, by Town, P. W. Taylor, chn. Building Comn., Town Clerks Office, Town Hall, 2 story, basement, brick, stone, elementary and junior high school, concrete founds., Washington and Walnut Sts. $175,000. **P.W.A.** B. Proctor, Jr., 173 Milk St., Boston, archt.

Mass., Westborough—Oct. 23, by Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, furnishing, installing laundry machinery equipment at State Hospital. To exceed $5,000. P.W.A. project.

Mass., Westminster—Oct. 22, by Town, Bd. Selectmen, 1 story, basement, 110x115 ft. and 45x80 ft. brick, stone, steel school. $105,000. O. A. Thayer, 89 Franklin St., Boston, archt. Noted Aug. 30.

Mass., Wrentham—Oct. 24, by Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, brick, concrete boiler house addition and alterations at State School. Albert B. Franklin, Inc., 38 Chauncy St., Boston, engrs.

†**Mich., St. Johns**—Nov. 6, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office.

Mo., Liberty—Clay Co., bids about Nov. 10, 3 story, basement, 87x117 ft., Indiana limestone court house. $275,000. Wright & Wright, 400 1st Natl. Bank Bldg., Kansas City, engrs. Noted July 19.

†**N. J., Caldwell**—Oct. 22, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $73,700.

N. Y., New York—Oct. 30, by Dpt. Health, 139 Centre St., general construction sanitary work, electrical work, laboratory equipment, etc., for Biological Research Laboratory, at Willard Parker Hospital, 16th St. and East River. Sibley & Fetherston, 205 East 42nd St., archts.

N. Y., Remsen—Oct. 23, by Bd. Educ., Remsen Central School, 2 story, basement, 150x150 ft., brick school, plain found. $164,000. Barg & Newkirk, U.G. and E. Bldg., Utica, engrs. and archts. **P.W.A.** Noted Aug. 2.

N. Y., Spencerport—See "Contracts Awarded."

O., Columbus—Oct. 22, by J. McSweeney, dir., P. Welfare, State Office Bldg., 500 hp. steam generating unit and stoker complete to be installed in Ohio Penitentiary. $70,000.

†**Pa., Phila.**—Oct. 31, by Yards & Docks, Navy Dpt., Wash., D. C., aircraft factory at Navy Yard. $2,600,000. Noted Oct. 11.

†**Pa., Pittsburgh** — Oct. 29, by U. S. Eng., Pittsburgh, contracting and operating building and a shelterhouse at Montgomery Island, Lock and Dam, Ohio River.

†**Pa., Swarthmore**—Nov. 7, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office.

S. D., Sioux Falls—Oct. 31, by Bd. Educ., general contract remodeling and constructing 3 story, brick school addition. $135,000. P.W.A. project. Hugill & Blatherwick, 366 Boyce-Greeley Bldg., archts. Noted Oct. 11.

CONTRACTS AWARDED

Ark., Conway—Arkansas State Teachers College, constructing dormitory, to W. Peterson, Donaghey Bldg., Little Rock, $86,350***plumbing and heating, to Brooks Turner, Warren, $21,370***electrical work, to Conway Electric Co., Conway, $3,398***furniture and equipment, to Manufacturers Furniture Co., 600 West 7th St., Little Rock, $11,798. Grand total $122,916. **P.W.A.** Noted Apr. 26.

Calif., Pasadena—Bd. Educ., reconstructing, rehabilitating, strengthening Madison Elementary School, incl. new rein.-con. found., gunite exterior walls, to H. Mayson, 9315 Hooper Ave., Los Angeles, $106,852. **P.W.A.** Bids Sept. 25. Noted Sept. 20.

†**Calif., San Diego**—Yards & Docks, Navy Dpt., Wash., D. C., repairing and improving buildings, Spec. 7803, to John F. and Laura Jackman Shanley, 2700 Kittner Blvd., $4,345 ***replacing machinery, Spec. 7792, to West Coast Gas Eng. Co., 312 West Market St., $3,299.

†**Conn., Plainville**—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to Tremaglio Bros., 1500 Highland Ave., Waterbury, $34,900.

†**Ga., Valdosta**—Treas. Dpt. at office Sup. Archt., Wash., D. C., extending and remodeling U. S. Post Office, to Batson Cook Co., West Point, $50,384. Bids Sept. 18. Noted Sept. 6.

†**Illinois**—Twenty-First Forestry Dist., Jefferson Barracks, Mo., to R. E. Jones, Springfield, 1 barracks and forestry building at Camp Springfield, $4,297; 1 barracks building at Camp Pere Marquette, $2,148***1 barracks building at Camp Havana, $2,078***to R. L. Baker, Jerseyville, 1 barracks building at Camp Piasa, $2,412. Grand total $10,935. Bids Sept. 27.

†**Ill., Effingham**—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to A. C. Atherton, 1024 Judson Ave., Evanston, $42,418. Bids Aug. 23. Noted Aug. 9.

†**Ill., Fairfield**—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to J. C. Miller, Campbellsville, Ky., $36,555. Bids Sept. 27. Noted Sept. 6.

†**Ill., Monticello**—Treas. Dpt. at office Sup. Archt., Wash., D. C., general contract 1 story, basement, brick, concrete post office, to D. Bright, Clinton, Ind., $36,700. Bids Sept. 20. Noted Sept. 20.

Ind., Terre Haute—Indiana National Guard, 1 story, basement, 100x150 ft., brick, steel.

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†*Federal Government.*

Public Buildings (Continued)

concrete armory, to G. W. North Constr. Co., 9th and Tippecanoe Sts.

Ia., Atlantic—Cass Co., electric light fixtures for court house, to Pickens & Williams, Atlantic, $1,750. **P.W.A.** Noted Aug. 2, under "Contracts Awarded."

†**Ky., Mayfield**—Treas. Dpt. at office Sup. Archt., Wash., D. C., remodeling and extending U. S. Post Office, to J. C. Miller, Campbellsville, $45,228. Bids Aug. 28. Noted Aug. 16.

†**Md., Aberdeen**—Con. Q.M., sub-guard house, to Nicola Building Co., 6388 Pennsylvania Ave., Pittsburgh, Pa., $3,995. Bids Sept. 26.

Md., College Park — University of Maryland, 2 story, basement, 42x200 ft. Women's Dormitory "B," to Price Constr. Co., Md., Trust Bldg., Baltimore. Est. $150,000. Former contract rescinded. Noted May 17, under "Contracts Awarded."

†**Mass., Boston**—Treas. Dpt. at office Sup. Archt., Wash., D. C., improving passenger elevator operation at Boston Custom House, to Westinghouse Electric Elevator Co., 1500 North Branch St., Chicago, Ill., $13,636.

Mass., Foxboro—Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, furnishing, installing boilers and soot blowers in boiler house at State Hospital, to Erie City Iron Wks., 25 Huntington Ave., Boston, $18,800. Bids Aug. 10, awarded Oct. 4. **P.W.A.**

Mass., Framingham—Commonwealth of Massachusetts, Dpt. Correction, State House, Boston, heating for 2 cottages at State Hospital, to McMurrer Co., 303 Congress St., Boston, $13,615; plumbing, to Jas. A. Cotter Co., 334 Shawmut Ave., Boston, $21,137. **P.W.A.** Bids July 25, awarded Oct. 4. Noted July 19.

†**Mass., Springfield**—Federal Land Bank, 310 State St., Springfield, general contract bank addition, to Turner Constr. Co., 137 Newbury St., Boston•••heating, ventilating, cooling and air conditioning, to Jennison Co., 17 Putnam St., Fitchburg•••plumbing, to W. J. Hyland Mfg. Co., 151 Dwight St.•••elevator, to Otis Elevator Co., 130 Clarendon St., Fitchburg. Est. $225,000. Noted Sept. 7.

†**Mass., Springfield**—Federal Land Bank, 310 State St., electrical work for bank addition, to J. Wilkinson & Co., 128 Oliver St., Boston. Noted Sept. 7.

†**Mich., East Lansing**—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to Sorensen Gros Constr. Co., 2491 Mason St., Flint, $34,934. Bids Oct. 1. Noted Sept. 13.

†**Mich., Gladstone**—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to V. and J. Jacobson, 4551 McCulloch St., Duluth, Minn., $36,022. Bids Aug. 9. Noted July 26.

†**Minn., International Falls**—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to Fleisher & Son Co., 44 Loeb Arcade Bldg., Minneapolis, $49,856. Bids Oct. 1. Noted Sept. 13.

Mo., Kansas City—City, general contract, 2 and 3 story, 123x166 ft., brick, stone central heating plant at General Hospital, to I. E. Dunn Constr. Co., 502 Reliance Bldg., $151,638 •••boiler and boiler settings, to William Bros. Minor Bldg., $28,447•••refrigeration, to U. S. Eng. Co., 914 Campbell St., $27,573. Grand total $207,658. Bids Sept. 27.

N. Y., Mount Upton—F. W. O'Connell, general contractor, 332 Water St., Binghamton, structural steel for school for Bd. Educ., to Bethlehem Constr. Co., Bethlehem, Pa. Total est. $81,000. **P.W.A.** Noted Aug. 9, under "Contracts Awarded."

N. Y., Spencerport—Bd. Educ., 2 story, basement grade and high school, Lyell Ave., day labor, $110,000. T.E.R.A. will hire and pay for labor. C. C. Ade, 80 East Ave., Rochester, archt. Noted Sept. 20.

N. Y., Wellsville—Bd. Comrs. Municipal Water & Light Plant, new boiler house at municipal water and light plant, to L. C. Whitford, 126 Main St., $21,493. **P.W.A.** Bids Sept. 28. Noted Sept. 20.

O., Hillsboro—City, constructing brick, concrete school and gymnasium, to P. W. Johnson, Portsmouth, $123,771. **P.W.A.** H. Erwin, Hillsboro, archt.

Wash., Pullman—Washington State College, general contract science building, to R. B. Hammond, Inc., Public Service Bldg., Portland, Ore., $212,736•••furnishing ornamental hardware for chemistry building, to Marshall-Wells Co., 508 Lovejoy St., Portland, Ore., $2,259•••elevators in chemistry building, to Otis Elevator Co., 1207 2nd St., Spokane, Wash., $3,490. Grand total $218,485. **P.W.A.** Bids Oct. 12. Noted Oct. 4.

†**Wisconsin**—U. S. Forest District, to A. J. Butler, Laona, constructing barracks buildings at Camp Dunbar, Dunbar, $1,775; Camp Section 11, at Three Lakes, $1,775•••to Schraufnagel Bros., Butternut, Camp Beaver, Clam Lake, $1,825; Camp Upson, Upson, $1,625•••to W. C. Smith, Inc., Duluth, Minn., Camp Riverside, Danbury, $1,782; Camp Star Lake, Star Lake, $1,763; Camp Crystal Lake, Star Lake, $1,722 •••to H. Schwert, Glidden, Camp Clam Lake, Clam Lake, $3,312•••to A. H. Proksch, Iron River, Mich., Camp Mondeau River, Westboro, $1,780; Camp Jump River, Westboro, $1,790; Camp Tomahawk, Tomahawk, $1,775•••to Mattoon Hardware Co., Mattoon, Camp Perkinstown, Perkinstown, $3,500•••to J. H. Jansen, 3001 North 38th St., Milwaukee, Camp Sheridan Park, Cudahy, $2,222; Camp Whitnall Park, Hales Corner, $2,220. Grand total $28,666. Bids Sept. 24.

Ont., Brockville—C. S. Walters, deputy minister Dpt. P. Wks., Toronto, constructing chimney for boiler house, to Francis Hawkin & Co. Ltd., Toronto; boilers, stokers, etc., to E. Leanard & Sons, 351 York St., London. Noted Sept. 27, under "Contracts Awarded."

COMMERCIAL BUILDINGS

PROPOSED WORK

Calif., Los Angeles—Los Angeles Union Terminal (organized by Santa Fe, Union Pacific and Southern Pacific Rys.), 726 North Alameda St., plans by Parkinson & Parkinson, 808 Title Insurance Bldg., union passenger station on Plaza site, grade separations and 2 bridges. $1,000,000 to $10,000,000. M. C. Blanchard, 634 North Cherokee Ave., ch. engr. A. J. Barclay, constr. supt. for terminal, 726 North Alameda St., will direct all construction.

Calif., Los Angeles—Municipal Housing Comm., D. Tyler, secy., 417 South Hill St., plans completed by G. Adams, W. Davis, J. Kibbey, R. Montgomery, W. Mullay, and Lloyd Wright, 3828 Amesbury Rd., housing project, 1st and Utah Sts., replacing existing residential buildings, would consist of series of 2 story, fireproof multiple dwellings, containing total of 1,529 apartments. $4,000,000-$5,000,000.

La., New Orleans—**C. H. Ellis**, vice pres. United Fruit Co., 321 St. Charles St., soon lets contract installing air conditioning system in 10 story United Fruit Building. Diboll & Owen, Ltd., Canal Bank Bldg., archts.

Mo., Hermann—J. H. Helmers, c/o Johnson & Maack, archts., Chemical Bldg., St. Louis, soon lets contract 2 story, 35x105 ft., brick, concrete, terra cotta theatre, C. M. Bassman, lessee.

BIDS ASKED

Mass., Braintree—See "Contracts Awarded."

N. Y., Brooklyn—See "Contracts Awarded."

N. Y., Smallwood—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Burbank—Warner Bros.-First National Studios, 4 new stages built in 2 double units, each unit 130x304 ft. in area, steel frame structures with steel trusses, rock wool insulation, steel sliding doors, gas-steam heating, etc., $300,000; also an additional $100,000 will be spent for sound and other equipment. Work will be handled by Owner's department of permanent construction, sub-contracts for steel, and possibly 1 or 2 other trades being awarded. Private plans.

Calif., San Francisco—W. P. Day, archt., Financial Center Bldg., part 1 and 2 story, reinf. con. publishing plant for Recorder Printing & Publishing Co., 460 4th St., to Cahill Bros., 206 Sansome St., $165,000; heating and humidifying system, to Carrier Eng. Corp. of California, 748 East Washington St., Los Angeles. Bids about Sept. 25, awarded Oct. 4. Noted Sept. 27.

Conn., New Haven—Marc Eidlitz & Sons, general contractors, 100 East 42nd St., New York, stone setting for Timothy Dwight Unit, Temple, Grove and Wall Sts., for Yale University, to Alexander Howie, Inc., 117 East 20th St.•••plumbing, to Buckingham Routh Co., 64 Grove St.•••wood trusses, roofing, to C. H. Dresser & Sons, Inc., Sheldon St., Hartford••• waterproofing, to C. R. Cummings Co., 198 State St., Meriden. Noted July 19, under "Contracts Awarded."

Mass., Braintree—R. A. Nordblom, Inc., 18 Oliver St., Boston, constructing two hundred fifty 2 story, basement residences in Braintree Highlands, separate contracts. Est. $5,000 each. Owner will ask bids on various materials, etc. Private plans.

N. Y., Brooklyn—A. Goldberg, 66 Court St., 6 story apartment, Ocean Ave. and Avenue K, separate contracts, $175,000. Kavy & Kavovitt, 16 Court St., archts. Noted Sept. 27.

N. Y., Smallwood—A. N. Smallwood & Co., 9 East 45th St., New York, 1 and 2 story, frame dwellings and tract development, separate contracts. To exceed $100,000. Private plans.

INDUSTRIAL BUILDINGS

PROPOSED WORK

N. Y., New York—BAKING PLANT—Gottfried Baking Co., 715 11th Ave., bids after Oct. 20, (from selected list of bidders) elevator, altering tanks, etc., at baking plant, 715 11th Ave. $30,000. H. Ginsbern, 205 East 42nd St., archt. Noted Oct. 8.

BIDS ASKED

Conn., New Britain—OIL TERMINAL—See "Contracts Awarded."

Idaho—MINING DEVELOPMENT—See "Contracts Awarded."

Nevada—GOLD MINING DEVELOPMENT, etc.—See "Contracts Awarded."

N. Y., Brooklyn—SERVICE GARAGE—See "Contracts Awarded."

B. C., Stewart—POWER PLANT, etc.—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Richmond—PLANT—Standard Oil Co. of California, 225 Bush St., San Francisco, constructing solvent plant for treatment of lubricating oils, to Fluor Corp. Ltd., 909 East 59th St., Los Angeles, approximately $300,000. Awarded Oct. 5. H. H. Hall, c/o owner, chf. engr.

Calif., Santa Paula — PLANT — Teague-McKevett, Santa Paula, packing plant additions, new basement, superstructure improvements, to Rainey & McIsaac, 6624 Standford Ave., Los Angeles. Est. $65,000. R. C. Wilson, Say Bldg., archt.

Conn., Greenwich — WAREHOUSE — John L. Duge & Sons, general contractor, 148 Railroad Ave., miscellaneous iron in connection with 2 story, 85x135x135 ft. warehouse, to Connecticut Iron Wks., 537 South Greenwich Ave.•••steel, to McClintic Marshall Co., 25 Bway., New York •••steel erection, to Leake & Nelson Co., Ash St., Bridgeport•••steel sash, to Detroit Steel Products Co., 420 Lexington Ave., New York •••plumbing and heating, to L. A. Hennessey, 79 Arch St.•••electrical work, to James G. Fox, 356 Greenwich Ave., for Electrolux, Inc., 500 5th Ave., New York. Noted Sept. 27, under "Contracts Awarded."

Conn., New Britain—OIL TERMINAL—Koppel Bros. Fuel & Oil Co., 262 Elm St., oil terminal, incl. concrete retaining wall, 2 fuel oil tanks, 10,000 gal. and 12,000 gal. capacity, concrete founds., separate contracts. Private plans.

Idaho — MINING DEVELOPMENT — Idaho Gold Corp., c/o Miller Murray & Co., 444 Madison Ave., New York, mining development at various locations, day labor. To exceed $40,000.

Mo., St. Louis—FACTORY—Carter Carburetor Co., 2838 North Spring Ave., 1 story, 70x120 ft., brick, steel carburetor factory addition, 2838 North Spring Ave., to Austin Co., 1102 Arcade Bldg. Est. $100,000. Noted Sept. 20.

Mont., Great Falls—REFINERY—Home Oil Refining Co., remodeling present 1,200 bbl. pipe still refinery equipped with Braun fractioning column and two 80 hp. boilers, construction will include latest type of cracking unit to be 2-coil selective cracking type of 1,000 bbl. capacity, to R. M. Parsons Co., Mount Vernon, O.

Neb., Omaha—WAREHOUSE and SERVICE STATION, etc.—Nebraska Farmers Union, Exchange Bldg., general contract wholesale warehouse, auto and truck service station, and retail store and office building, to P. McArdle, 526 South 51st Ave. Est. $100,000. Noted Mar. 8.

Nevada—GOLD MINING DEVELOPMENT, etc.—Great Dike Gold Mines, c/o Ross Associates, 49 Wall St., New York, gold and precious metal mining development, at various locations, by day labor. $162,000 stock issue will be used for financing project.

N. Y., Brooklyn—SERVICE GARAGE, etc.—White House M. & C. Co., Snedicker and Liberty Aves., 1 story, 55x100 ft., brick, steel, Snedicker and Liberty Aves., separate contracts. $35,000. Kavy & Kavovitt, 16 Court St., archts. Noted Sept. 27.

N. Y., Long Island City—WAREHOUSE—National Sugar Refining Co., 129 Front St., New York, general contract Warehouse 6, 1 story, 128x210 ft., brick, 2nd St., to Sobray-Whitcomb Co., 105 West 40th St., New York, approximately $40,000•••foundations, to E. Woodruff, 21-37 46th Ave.•••steel, to Ingalls Iron Wks., 1 East 42nd St., New York. Noted Aug. 16, under "Contracts Awarded."

N. Y., New York—STORAGE and STABLE—Seven Hundred Forty Water Street Corp., G. Baxter, pres., 275 Cherry St., altering elevators, new boiler room and gasoline storage in 3 story, stable and storage, 740 Water St., to Paul & Murphy Contg. Co., 448 6th Ave. Est. $28,000 or more. Noted Oct. 4.

B. C., Stewart—POWER PLANT, etc.—Northern British Columbia Power Co., moving present diesel electric power plant and installing new units, construction and changes to transmission lines (new plant not yet bought). $91,500. Owner builds, force account. D. B. Craig, Stewart, B. C., and Montreal, Que., engr.

Ont., Galt — PLANT — Riverside Silk Mills, Melville St., 1 story, 35x86 ft. and 3 story, 30x86 ft. plant additions to G. H. Thomas & Son, 45 Dickson St. J. Evans, 30 Water St., archt.

Ont., New Liskeard—FOUNDRY—Wabi Iron Works, Ltd., constructing new foundry, to P. Hjertholm, 1135 Beaver Hall Hill, Montreal, Que.; steel, to Sarnia Bridge Co., Sarnia. Noted Oct. 4.

Ont., Toronto—FACTORY—Dr. Jackson Foods Ltd., 108 Vine St., 2 story, 50x150 ft., brick, steel addition, plain found., Vine St., to John S. Laxton, 34 Barkdale Rd., $35,000. Sub-contracts also let. J. A. Lunt, 495 Glenholme Ave., engr.

Que., Noranda—PLANT—Noranda Mines Ltd., 804 Royal Bank Bldg., Toronto, Ont., 1 story cyanidation plant. Owner builds. $200,000, of which $50,000 will be for equipment. Private plans.

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